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Col. Reid's Law of Storms Examined. *By* James P. Espy.

(Concluded from p. 231.)

Col. Reid has copied into his work the documents furnished by Mr. Redfield concerning the storm of August, 1830. This storm, if indeed it was one, and not many, was upwards of 1000 miles long from N.N.E. to S.S.W., and at least five times as long as it was broad on the 17th. This fact, though it seems to have escaped the notice both of Mr. Redfield and Col. Reid, is abundantly proved by the following documents. For it will be seen that the brig Mary had a gale in lat. 27° 55′, lon. 76° 50′, which lasted till the 17th, and that on the same day the storm was felt at several points N.N.E. of the brig Mary, as far as Long Island Sound. And on the 18th, its length appears to be still greater, for it seems to have reached from lat. 28°, lon. 66°, where the wreck of the Julia was seen on that day, to lat. 41° 20′, lon. 66° 25′, where the hurricane was tremendous on the 18th from N.N.E.

Whether this storm traveled side foremost exactly or not, cannot be ascertained by the documents collected. It certainly moved towards the eastward.

It is even doubtful whether it was one continuous storm, or composed of several. Yet it will be seen that it commenced at Wilmington, N. C. four hours sooner than at Charleston, S. C., and at Charleston one hour earlier than at Savannah, Ga.

But this does not prove positively that the storm was not the same at all three places, or that it moved backwards towards the S.W. For a storm of such great length moving side foremost, might have some portions of it advanced before the others, for aught that is known in the present state of

the science. It is possible, however, that the Wilmington date is incorrect by twenty-four hours; and if so, the anomaly here spoken of would disappear. It is hoped that this matter will be settled hereafter. However it may be, the shape of the storm utterly precludes the idea of the whirlwind character, even if the direction of the wind had not been given in the several localities. But when the reader comes to the data below, imperfect as they are, he will discover this remarkable fact: that on the 17th, the wind in the Atlantic, some distance from the coast, was blowing from the S.E. all the way from Georgia to Maryland, and at the same time on shore for that whole distance it was blowing from the N.W.; and that N.E. of Maryland, as far as Long Island Sound, the wind was N.E., and that the only record we have of a ship on the S.W. of this area, the Blanche, shows the wind on the 17th all day from the S.W., with fresh breezes at the end of a violent storm.

There are some deviations it is true, but not so great as to prevent the above statement being, in the general, true. I shall now give all the documents as copied by Col. Reid from Mr. Redfield, together with some additional ones which I have found in the newspapers of that time, and leave the reader, without a woodcut of this storm, to examine the documents for himself. In doing so, I would recommend him to have a map of the coast of the U. S. open before him.

Hurricane of 1830.

"This storm, or hurricane, was severe at the Island of St. Thomas, on the night between the 12th and 13th of August, 1830.

"On the afternoon of August 14, and the succeeding night, it continued its course along the Bahama Islands, the wind veering almost round the compass, during the existence of the storm.

"On the 15th of August the storm prevailed in the Florida channel, and was very disastrous in its effects.

"In lat. 26° 51′, lon. 79° 40′, in the Florida stream, the gale was severe on the 15th, from N.N.E. to S.W.

"Late on the 15th, off St. Augustine, Florida, in lat. 29° 58′, lon. 80° 20′, the gale was very severe.

"At St. Andrews, 20 miles N. of St. Mary's, Georgia, from 8 o'clock P. M. on the 15th, to 2 A. M. on the 16th, the storm was from an eastern quarter, then changed to S.W., and blew till 8 A. M.

"Off Tybee, and at Savannah, Georgia, on the night of the 15th, changed to N.W. at 9 A. M. on the 16th, and blew till 12 M.

"At Charleston, S. C. on the 16th, the gale was from the S.E. and E. till 4 P. M., then N.E., and round to N.W.

"At Wilmington, N. C., the wind was from the E., and veered subsequently to the W.

"In the interior of North Carolina, the storm was felt at Fayetteville.

"In the vicinity of Cape Hatteras, at sea, the storm was very heavy from the S.E., and shifted to N.W.

"A vessel bound from New York to Hayti, in the middle or outer part of the Gulf Stream, about lat. 33°, lon. 72°, experienced the gale moderately from the S.W. and S.S.W., but with a heavy sea from a very westerly direction, and is supposed to have been on the outer margin of the storm.

"Another vessel, at about the same distance from the coast, experienced similar effects.

"Early on the morning of the 17th, the gale was felt severely at Norfolk, and also in Chesapeake Bay from the N.E.

"Off the Capes of Virginia, on the 17th, in lat. 36° 20′, lon. 74°, 2′, 'a perfect hurricane,' from S. to S.S.E., from 5 A. M. to 2 P. M., then shifted to N.W.

"On the 19th, (17th?) in lat. 37° 30′, lon. 74° 30′, near the coast of Virginia, the gale was severe at E.N.E., and changed to W.N.W.

"Off Chincoteague, Md., precise distance from the coast unknown, the gale was severe between S.S.E. and N.N.E.

"Off the coast of Delaware, in lat. 38°, lon. 72°, 'tremendous gale,' commencing at S.E. at 1 P. M. on the 17th, and blowing six hours, then changed to N.W.

"At Cape May, N. J., the gale was N.E. Off Cape May, in lat. 39°, lon. 74° 15′, heavy gale from E.N.E. on the afternoon of the 17th of August.

"Near Egg Harbour, coast of New Jersey, the gale was heavy at N.E. on the same afternoon.

"Off the same coast, in lat. 39°, lon. 73°, the gale at E.N.E.

"In the same lat., lon. 70° 30′, 'tremendous gale,' commencing at S.S.E. and veering to N.

"At New York, and on Long Island Sound, the gale was at N.N.E. and N.E. on the afternoon and evening of the 17th.

"Off Nantucket Shoals, at 8 P. M., the gale commenced severe at N.E. by E.

"In the Gulf Stream, off Nantucket, in lat. 38° 15′, lon. 67° 30′, on the night of the 17th, 'tremendous hurricane,' commencing at S., and veering with increasing severity to S.W., W., and N.W.

"At Elizabeth Island, Chatham, and Cape Cod, Mass., the gale was severe at N.E. on the night between the 17th and 18th of August.

"On the 18th, heavy gale from N.E. at Salem and Newburyport, Mass.

"Early on the 18th, in lat. 39° 51′, lon. 69°, severe gale from S.E., suddenly shifting to N.

"In lat. 41° 20′, lon. 66° 25′, 'tremendous hurricane' from N.N.E. on the 18th of August.

"On the night of the 18th, off Sable Island, and near Porpoise Bank, in lat. 43°, lon. 59° 30′, 'tremendous gale from S. and S.W. to W. and N.W.

"In lat. 43°, lon. 58°, severe gale from the S., the manner of change not reported. This remarkable storm seems to have passed over the whole route comprised in the foregoing sketch in about six days, or at an average rate of about 17 geographical miles per hour.

"The duration of the most violent portion of the storm, at the several points over which it passed, may be stated at from 7 to 12 hours.

"The general width of the tract, influenced, in a greater or less degree, by the gale on the American coast, is estimated to have been from 5 to 600 miles.

"Width of the hurricane portion of the tract, or severe part of the gale, 150 to 250 miles.

"Semi diameter of the hurricane portion of the storm, 75 to 125 miles.

"Rate of the storm's progress from the Island of St. Thomas to Providence Island, Bahamas, 15 nautical miles per hour.

"Rate of progress from Providence to St. John's, Florida, 16 miles per hour.

"From St. John's to Cape Hatteras, N. C. 16½ miles per hour.

"From Cape Hatteras to Nantucket, on the south-eastern coast of Massachusetts, 18 miles per hour.

"From Nantucket to Sable Island, off the south-eastern coast of Nova Scotia, 20 miles per hour."

Extract of a letter from the Master of the Ship Illinois.

I sailed from New Orleans on the 3d of August, bound to Liverpool. Nothing worth notice occurred until the 15th of August, in lat. 33°, N. lon. 77° 10′, when there was a very heavy swell from the S., more than ever I had experienced before in this part, unless preceded by heavy gales. We had no indication of wind at this time, but there was a dull and heavy appearance in the S. During the day, the wind was light and at S.E.; at night it shifted to S.S.W. On the 16th, it was a fresh and wholesome breeze; so that with the help of the Gulf Stream we ran at a great rate, steering N.E., and at noon we were in lat. 36°, lon. 73°. On the 17th, the wind continued steady at S.S.W., blowing a strong and wholesome breeze, but the appearance to the S. continued dull and heavy; the sea was smooth again, and we seemed to have outrun the southerly swell. At noon, lat. 37° 58′, lon. 69° 23′, we were still continuing to run about the course of the Gulf Stream; the temperature of the water was 86° on the first of the 18th, (afternoon of the 17th, current time,) the wind backed to the S., and began to freshen in very fast; some heavy clouds arising in the S. W., with flashes of lightning in that quarter. At 8 P. M. the wind had increased to a strong gale; the weather at this time had an unusual appearance, but still it did not look bad. At 10, the wind had increased, and we took in our sails, and prepared for the worst. At 11 o'clock, the sea ran high and cross, which induced me to heave the ship to under a close reefed topsail. At half past 12, midnight, all was darkness; the heavy clouds which had been rising in the S.W. had overtaken us; the rain fell in torrents, and the lightning was uncommonly vivid; the wind had increased in the space of an hour from a moderate gale to a perfect hurricane. At half past 1 A. M., it began to veer to the westward. At 3 A. M. it was west, and rather increased in violence, as it shifted. At daylight, the sky was clear, but the gale, if any thing, rather increased in its fury; the sea was tremendous, and ran in every direction. At 7, the wind had got to the N.W., and at 9 it began to abate a little.

Extract from the log of the Blanche.—At 1 A. M. of the 15th, wind N. easterly, fresh breezes and squally. At 6, wind northerly, strong gales, with violent squalls; at 9 a hurricane; at 11h. 30m. wind changed to N.W. and blew more violently.

At 1 P. M. south-westerly; at 2 more moderate; at 4 ditto weather; at 7 wind W. by N.; from 8 till midnight, strong gales and squally.

At 1 A. M. of 16th, wind S. by E., strong gales and squally; at 8 ditto weather; at noon fresh gales and squally; at 1 P. M. wind S.W., fresh breezes and squally; at 6 and 8 strong gales.

At 1 A. M. of 17th, wind S. by W., fresh breezes and squally, with rain; at 10 fresh breezes with a heavy swell; at noon fresh breezes and cloudy weather; at 1 P. M. wind S.W., fresh breezes and cloudy weather, and so till midnight. On the 15th, at noon, lat. 27° 15′, lon. 79° 35′. On 16th, lat. 30° 12′, lon. 79° 22′. On 17th, lat. 31° 42′, lon. 76° 59′.

Documents of the Storm of 17th August, 1830, collected by J. P. Espy.

National Gazette of 28th.—A Norfolk paper of Thursday, 19th. The canopy has been overcast for two days with clouds, indicating a storm. The wind blew very heavy on Tuesday night, 17th, from N.E.; shifted yesterday morning to N., and is still blowing a gale, with every appearance

of something more severe in reserve. The tide was much higher yesterday in our harbour than on any day this season, overflowing most of the wharves.

Same paper of 26th. Crow Island, (North Santee) August 17. On Monday, the 16th, about an hour before day, we had a fall of rain, the wind at S.E. The rain fell in showers throughout the day, and the wind increased rapidly till 12, when it blew a hurricane. The wind continued from the same quarter, and increased till some time in the night. The tide rose higher than I ever saw it. Mr. Pinckney's vessel is on my island, near my barn.

Same paper of 31st. Ship Brilliant, on the 18th, lat. 40°, lon 71°, experienced a heavy gale of wind; had all the sails torn to tatters.

Nat. Gaz. of Sept. 7th. Schooner Neuse was wrecked on the S. side of Abaco, on the 15th.

Same paper of 8th Sept. The captain of the Neuse says that the hurricane commenced on the afternoon of the 14th, and lasted 18 hours—the gale was not felt at Nassau, only 60 miles distant. The brig Native was wrecked on the 15th on the S.W. part of Heneagus.

Same paper of 28th Sept. At New Orleans it blew a gale between the 15th and 20th. The Mary Jane was driven on shore on the S.W. side of Abaco. Same paper of 30th. The Ceres fell in with the wreck of the Julia in lat. 28°, lon. 66°, on the 18th Sept.

Same paper of Aug. 31. Sloop Excel was driven on shore on Wednesday, 18th, a little to the westward of Lynnhaven Inlet, during a severe blow from N.N.E.

Same paper of 30th Aug. At Wilmington, N. C. the New Hanover rode out the gale and went to sea on the 17th, the wind having subsided.

At Elizabeth City, N. C. the storm was terribly severe, with torrents of rain on Tuesday, the 17th. At Wilmington, N. C. it was on the night of the 15th, unless there is some mistake in the date—also very violent. In lat. 29° 58′, lon. 80° 50′, the barque New Prospect experienced a severe gale on the 15th and 16th, and was abandoned.

Same paper of 24th. At Charleston, S. C. the wind began to blow about midnight of 15th from S.E. and E.S.E., and continued with increasing force, doing much mischief, till about 4 P. M., when it changed to N.W.

Same paper of 22d. Near Norfolk, Virginia, the corn on either side of the road was completely prostrate, and large trees were torn up by the roots, by the violence of the gale.

Same paper of 21st. There was a heavy blow from the N.E. on the 17th, off Great Egg Harbour.

American Sentinel, Aug. 25th. The Damon, on the 17th, off Chincoteague, experienced a severe gale from S.E. to N.N.E., and the T. Sophia, in lat. 37° 30′, lon. 74° 30′, had a gale from N.N.W.

Aug. 26th. At Savannah, on Sunday night, 15th, from 1 till 9 o'clock of Monday, the 16th, severe gales and heavy rains at intervals from N.E. Between 9 and 10, wind changed to N.W., whence it continued without abatement till 12, when it moderated and blew from the westward during P. M.

Barque H. Astor was, on the 19th, in lat. 30°, lon. 68° 24′; had experienced, the day before, a tremendous hurricane from the N.N.E.—from New Orleans to New York.

Same paper of 27th. Brig Mary experienced a tremendous gale of wind on the 14th, in lat. 27° 59′, lon. 76° 50′, from the E.N.E., which shifted to

E.S.E., and it lasted three days. The John Shand was abandoned, having taken the gale on the 15th, in lat. 31°, lon. 77° 20′.

Same paper of 28th. At Washington, N. C. a violent gale of wind from S.S.E., and rain on Monday night, 16th.

Same paper of Aug. 31. Schr. Mary Ann, on 17th, lat. 38° 48′; severe gale from S.E. to S.S.E.

On 18th, in lat. 43°, lon. 58°, heavy gale from the southward. Off the Highlands, blowing very heavy from the northward.

National Intelligencer, Aug. 26th. At Wilmington, N. C., about 8 P. M. of 15th, the storm set in with hard blowing from the E., and increased gradually till 9, when the wind began to rage with as much fury as we can remember in any former storm, and continued so for four hours, changing to the W. between 11 and 12. On the same night, the wind at Charleston began to blow freshly from the S.E. and E.S.E. about 12, continuing with rapidly increasing violence the succeeding day, and still blowing with diminished violence on the 17th.

American Sentinel of August 24th. Aug. 18, lat. 37° 20′, lon. 75°, at 10 A. M., hove to in a heavy gale, S.E. At half past 12, wind hauled suddenly in to the N. and N.W., and blew a hurricane.

Same paper, Aug. 25. Lon. 72° 42′, lat. from 38° 21′ to 40° 30′, at noon appearance of a storm; at 3 to 4, violent hurricane; in P. M. changed suddenly to N., increasing to a tornado. Same paper says the wind changed round by N.E. suddenly about 4 P. M. of the 16th, at Charleston, and S. to N.W.

Same paper, Aug. 28. Schooner Packet, 30 miles S.E. of Tybee light, experienced the gale on the 16th, from S.S.E., shifting to W.S.W. Aug. 30. Capt. Hipkins experienced the gale on the 18th, in lat. 34° 45′, lon. 73°, but sustained no injury.

Same paper of 31st. Ship Hellespont, off Sable Island, experienced a severe gale from S.W. to N.N.W., which lasted eleven hours. Sept. 1. A tremendous hurricane from N.N.W. on 17th, in lat. 40° 14′, lon. 70°. Also ship Brilliant, lat. 40°, lon. 71°, experienced a heavy gale from the N. for 4 hours on the 18th.

Hospital, Philadelphia, Aug. 1830.

Day.	Therm. and Wind.			Atmosphere.		
	7h.	12h.	3h	7h.	12h.	3h.
14	68 E.	83 S.W.	85 S.W.	Fog.	Clear.	Clear.
15	74 S.W.	83 S.		Cloudy.	Cloudy.	Clear.
16	79 S.W.	91 S.W.	76 S.W.			
17	71 N.E.	71½ N.E.	69 N.E.	Rain.	Rain.	Rain.
18	61 N.W.	72 N.W.	74 N.W.	Clear.	Clear.	Clear.
19	64 N.W.	75 N.E.	79 N.E.	"	"	"

Rain on 15th,	0.16 inch.
" 16th,	1.10 "
" 17th,	61 "

These are all the documents which we have of this storm. They are very imperfect; yet they furnish proof of these three things:—

1st. The storm was several hundred miles longer from N.N.E. to S.S.W. than it was from W.N.W. to E.S.E.

2d. It moved eastwardly with a velocity not exactly ascertained; much less, however, than if its velocity should be estimated from its appearance along the coast of the United States.

3d. The wind set in generally out at sea from the S.E., and changed round to N.W.

From the following quotation, it would appear that a storm similar to this in shape had its longest diameter from E. to W., and traveled from N. to S. More information as to the shape of storms, and the direction in which they move, is much wanted.

"After a few days pretty fresh breezes from the S., clouds suddenly appeared in the N., and, by the motion of the water, we perceived that an equally strong wind was rising in that direction. The waves from the opposite regions foamed and raged against each other like hostile forces; but between them lay a path some fathoms broad, and stretching from E. to W. to an immeasurable length, which appeared perfectly neutral ground, and enjoyed all the repose of the most profound peace, not a single breath troubling the glassy smoothness of its surface. After a time, victory declared for Boreas, and he drove the smooth strip towards our vessel, which had hitherto been sailing in the territory of the S. wind.

"We presently entered the calm region; and while we had not a puff to swell our sails, the wind raged with undiminished fury on both sides. This strange spectacle lasted for about a quarter of an hour, when the N. wind, which had been continually advancing, reached us, and carried us quickly forward towards the place of our destination."—See Kotzebue's New Voyage Round the World, vol. ii., p. 72. Off California.

An Account of the Fatal Hurricane by which Barbadoes suffered in August, 1831, by the Editor of the West Indian.

Page 33.—"On the 10th morning of the month, the sun arose without a cloud, and shone resplendently through an atmosphere of the most translucent brightness. At 6 A. M. the thermometer stood as high as 83, which indicated the heat to be one degree greater than at sunset the preceding evening. At 8 it rose to 85, and at 10 to 86, at which hour the gentle breeze which had fanned the country died away. After a temporary calm, high winds sprang up from the E.N.E., which in their turn subsided; calms for the most part then prevailed, interrupted by occasional sudden puffs from between the N. and N.E. At noon the heat increased to 87, and at 2 P. M. to 88, at which time the weather was uncommonly sultry and oppressive. At 4 the mercury sank to 86. Until that hour the observations on the weather, as here detailad, were made in Bridgetown. At 5 P. M. the writer, being about a mile and a half to the northward of the town, remarked the clouds gathering very densely from the N.; the wind commenced to blow very freshly from the same point.

A shower of rain presently fell, and was succeeded by a sudden stillness, to which a solemnity was added by the dismal blackness of the horizon all around. The impenetrable body of cloud extended upwards towards the zenith, leaving there an obscure circle of imperfect light, the diameter of which appeared to be about 35 or 40 degrees of the celestial concave. This dismal circle remained at rest for a very few moments; when the scud of it was seen to be in a state of ebullition; the dense mass of clouds all around was agitated, and separating bodies of it were quickly dispersed to all points of the compass. From 6 to 7 the weather was fair and the wind moderate,

with occasional slight puffs from the N.; the lower and principal stratum of clouds passing fleetly towards the S., the higher strata and scud rapidly flying to various points: after 7, the sky was clear and the air calm: tranquillity reigned till a little after 9, when the wind again blew from the N. At half past 9 it freshened, and moderate showers of rain fell at intervals for the next hour. Distant lightning was observed at half past 10, in the N.N.E. and N.W. Squalls of wind and rain from the N.N.E, with intermediate calms succeeded each other until midnight, the thermometer in the meantime varied with remarkable activity; during the calms it rose as high as 86, at other moments fluctuated from 83 to 85.

After midnight, the continual flashing of lightning was awfully grand, and a gale blew fiercely from between the N. and N.E. At 1 A. M. of the 11th the tempestuous rage of the wind increased; the storm, which at one moment blew from the N.E., suddenly shifted from that quarter, and burst from the N.W. and intermediate points. The upper regions were, from this, illuminated by incessant lightning, but the quivering sheet of blaze was surpassed in brilliancy by the darts of electric fire which were explored in every direction. At a little after 2, the astounding roar of the hurricane which rushed from the N.N.W. and N.W. cannot by language be described. About 3, the wind occasionally abated, but intervening gusts proceeded from the S.W., the W., and W.N.W., with accumulated fury. The lightning also having ceased for a few moments only at a time; the blackness in which the town was enveloped was inexpressibly awful. Fiery meteors were presently seen falling from the heavens; one in particular, of a globular form, and a deep red hue, was observed by the writer to descend perpendicularly from a vast height. It evidently fell by its specific gravity, and was not shot or propelled by any extraneous force. On approaching the earth, with accelerated force, it assumed a dazzling whiteness and an elongated form, and dashing to the ground in Beckwith Square, opposite the stores of Messrs. H. D. Grierson and Co., it splashed around in the same manner as melted metal would have done, and was instantly extinct. In shape and size, it appeared much like a common barrel shade. Its brilliancy, and the sparkling of its particles on meeting the earth, gave it the resemblance of a body of quicksilver of equal bulk. A few minutes after the appearance of this phenomenon, the deafening noise of the wind sank to a solemn murmur, or, more correctly expressed, a distant roar, and the lightning, which, from midnight, had flashed and darted forkedly, with few and but momentary intermissions, now, for the space of nearly half a minute, played frightfully between the clouds and the earth, with novel and surprising action; the vast body of vapour appeared to touch the houses, and issued downward flaming blazes, which were nimbly returned from the earth upward. The corruscations, for the short space of time they continued, instantly succeeding each other. This strange quivering, or darting, of flashes down and up, may be compared to the miniature blazing produced by the rapid and irregular discharge of opposing artillery closely engaged. Whilst this remarkable phenomenon proceeded, the earth vibrated in a manner, and in time, answering with the action of the lightning. Twice, or more, when the corruscations were more brilliant and severe, but less rapid in succession, the earth received corresponding shocks. The moment after these singular alternations of lightning, the hurricane again burst from the western points with violence prodigious beyond conception, hurling before it thousands of missiles, the fragments of every unsheltered structure of human art. The strongest houses were caused to vibrate to their foundations, and

the surface of the very earth trembled as the destroyer raged over it. No thunder was at any time distinctly heard;—had the cannon of a hundred contending armies been discharged, or the fulmination of the most tremendous thunderclaps rattled through the air, the sounds could not have been distinguished. The horrible roar and yelling of the wind, the noise of the tumultuous ocean, whose frightful waves threatened the town with the destruction of all that the other elements might spare, the clattering of tiles, the falling of roofs and walls, and the combination of a thousand other sounds, formed a hideous din, which appalled the heart, and bewildered, if not alienated, the mind. No adequate idea of the sensations which then distracted and confounded the faculties, can possibly be conveyed to those who were distant from the scene of terror. The sheltered observer of the storm, amazed and in a state of stupor, was fixed to the spot where he stood; the sight and the hearing were overpowered, and the excess of astonishment refused admission to fear. What must have been the mental agonies of those wretched fugitives, who, destitute of a place of refuge, were the sport of the dreadful tempest, and alive to all its horrors! This unparalleled uproar continued, without intermission, until half past 4, the raging blast coming from the W., and other points to the southward of it, attended with frequent dashing and pelting rain. After 5 o'clock, the storm now and then for a few moments abated, at which time the dreadful roar of the elements having partially subsided, the falling of tiles and building materials, which, by the last gust, had probably been carried to a lofty height —the shrieks of the suffering victims—the cries of the terrified inhabitants, and the howlings of dogs, were clearly audible, and awakened the mind to an apprehension of the havoc and carnage which had been, and still were, desolating the colony.

At half past 5, after a dreadful gust from the W.S.W., the wind suddenly chopped round to the E., from whence it blew a moderate gale, which in a minute increased, and changing to the S.E., a hurricane again raged, but unaccompanied by those fatal gusts, which, from the western quarter, had effected so much destruction. Torrents of rain at this time fell. At 6, the hurricane blew suddenly and tremendously from the S., driving the sheets of rain horizontally before it. This continued till 7, when the wind, then from S.E., was more moderate; but floods of rain still deluged the ruins of the town, and the population, who were now destitute of any shelter. At 8 A. M., strong breezes blew from E.S.E.; after that hour, the dense cloud began to break up, and at 10, the sun for a few moments darted its rays over a prospect of wretchedness more replete with real misery and sickening to the heart, than the field of battle after a sanguinary contest."

The centre of this storm appears to have passed a little to the N. of Barbadoes, and over the southern extremity of St. Lucia.

On the evening of the 10th, no unusual appearance had been observed at St. Lucia; but as early as 4 or 5 o'clock next morning, the garrison, stationed near the northern extremity of the island, began to be alarmed: some hut barracks blew down, and the wind was then nearly N.

The storm was at its greatest height between 8 and 10 o'clock in the morning; but from that time the wind gradually veered round to the E., diminishing in force and dwindling, as it were, to nothing in the S.E., and it was succeeded by a beautiful evening, with scarcely a breath of wind.

At the southern extremity of the island, the most violent part of the storm is reported to have been from the S. W. At St. Vincent, the garri-

son was at Fort Charlotte, near the S.W. point of the island; and there the wind first set in from N.W., veering to W. and to S.W., raising the water in Kingston Bay so as to flood the streets; and it unroofed several of the buildings in the fort, and blew down others: but at Martinique (as will be seen from the following report printed in the "London Shipping List," for 1831,) the wind was easterly during the gale.

"Paris, Sept. 15, 1831.—The Martial arrived at Havre from Martinique; sailed on the 15th of August. On the 11th of August, a gale at E. was experienced there which lasted six hours. The plantations suffered severely. Two vessels belonging to Bordeaux, and all the Americans at anchor in the road of St. Pierre, were driven out to sea. The army schooner, the Duke of York, on her return from Trinidad to Barbadoes, during this hurricane, was in sight of Grenada in the evening, and to the eastward of that island. About midnight she first began to experience hard squalls from the N.W., which caused the master to take in sail. The squalls increased until the vessel could carry no sail at all, and she was expected every moment to founder. Happily, at daylight, those on board of her unexpectedly found themselves drifted close to the island of Barbadoes.

These are all the accounts we have of this hurricane, yet, meagre as they are, the reader will perceive that during the two last hours of the hurricane at Barbadoes, after the wind changed round there S.E., it was N. at St. Lucia, and certainly between N.W. and S.W. at St. Vincent, and therefore at this time it was blowing inwards towards a central space, not far, undoubtedly, from where the middle of the storm then was.

I now take leave of Col. Reid for the present, thanking him most sincerely for the many interesting facts with which he has enriched the science of meteorology.

At some future time I shall have something to say of his water spouts—when I hope I shall be able to prove, by numerous facts, that the wind blows inwards, upwards in the middle, and outwards above, in this meteor, as well as in the great storms above investigated. Indeed, if it is certain that the wind blows inwards in one storm, there is a strong presumption that it does so in all.

Now, Howard says, in the tremendous gale of 20th March, 1812: "During the storm, the wind to the southward of the Humber, was from the S. W., whilst to the northward of it, it was strong from the N.E. and by E." And Mr. Forth found, in the storm of Jan. 8th, 1734–5, that while in all England, the barometer was at its lowest point, the wind was N.E. in the northern part of that isle, and S.W. in the southern part. (Obs. sur la Physique, vol. xxxix., p. 106. Also, Phil. Trans. Abridg. vol. ii., p. 497.

Franklin Institute.

REPORT OF THE COMMITTEE ON PREMIUMS AND EXHIBITIONS.

Tenth Exhibition of Domestic Manufactures held by the Franklin Institute of the State of Pennsylvania, for the Promotion of the Mechanic Arts.

To the Managers of the Franklin Institute.

The Committee on Premiums and Exhibitions having received from a majority of the Committees of Judges their reports upon the respective

merits of the various specimens deposited at the late Exhibition held by the Institute, and having decided upon the award of premiums, now close their labours by laying before the Board of Managers a report of their decisions, together with a brief detail of their general proceedings.

As soon as it was decided that an exhibition should be held this season, the Committee announced the design of the Institute in a Circular, which was distributed among the manufacturers in the different parts of the U. States.

The experience of former Exhibitions having shown that when a definite list of articles for which premiums would be awarded, was adopted, some inconvenience arose from the difficulty of foreseeing what would be the character of the specimens offered: the Committee, on this occasion, adopted a different and more liberal course, by leaving the whole matter open, so as to admit into competition all articles of American manufacture which should possess especial merit. They did not, therefore, publish any list of premiums, but invited competition in every possible shape. The result has more than justified their expectations, and clearly shewn the propriety of the course adopted.

In the month of September, the Committee, in accordance with the usual custom on previous occasions, invited a number of gentlemen who were interested in the subject, to assist in making the preliminary arrangements for the Exhibition.

These gentlemen, to the number of 157, were organized as a Committee of Arrangement by electing Mr. C. C. Haven as Chairman, and immediately upon their organization, commenced the performance of their duties with a zeal and spirit which gave excellent promise of an extensive and interesting Exhibition.

As the Committee of Arrangement advanced in their operations, the prospective extent of the Exhibition was such that it was thought advisable to devote to it not only the greater part of the interior of the Hall, but also to erect in front, on Chesnut street, a temporary building for the accommodation of cooking ranges and stoves, and for the reception of the more bulky articles of machinery and manufactures.

Arrangements were also made for providing a motive power for such machines as could be conveniently put in operation for the gratification of a laudable curiosity.

In consequence of invitations extended by the Committee on Premiums, the Exhibition was visited by a number of distinguished strangers from various sections of the Union, and by delegations from the American Institute and Mechanics' Institute of New York, both of which Societies had held Exhibitions of American Manufactures a short time previous to ours. Beside the gratification which the Committee derive from these visits on personal grounds, it is believed that much advantage must arise from them, both to the Institute and to the noble cause in which it is engaged, by promoting harmony of feeling and unison of efforts among all kindred institutions throughout our country.

This Exhibition is believed to differ from most of those which preceded it in one particular, which, although it was calculated to diminish in some measure its splendour as a mere show of the beautiful and curious, served to render it of greater interest to those who are conversant with the manufactures of our own and foreign lands. At former exhibitions we have generally had a large number of articles offered for premiums which have been made expressly for the occasion, and which were so entirely superior to the

usual quality of the article, as to be no criterion of the existing condition of the ordinary manufacture.

On the present occasion, however, by far the greater portion of the specimens exhibited were taken from the ordinary stock made for general sale, and, as has been observed by some of the Judges in their reports, are fair and honest samples of goods to be found in our stores on sale every day. As a highly gratifying evidence of the progress of the Arts, it may be added that many of these goods which are now considered as nothing out of the common course of productive industry, were reported no longer back than our last Exhibition, to be astonishing evidences of superior skill; but not fair samples of our usual manufactures: and others of them were at that time not recognized as articles of domestic production.

The same cause has served in some measure to diminish the comparative number of awards of Medals for superior excellence, and to increase that of Certificates of Honourable Mention, which may be awarded in all cases of excellence or merit, even where several articles of similar nature shall be found equally meritorious, and which is therefore a much less invidious mode of testifying to the skill of the Manufacturer than the former.

As the remarks made by the Judges, at the time of examining the articles, will serve to give a more just conception of the general character of the Exhibition than could be conveyed by a more elaborate description prepared after the whole had passed away, the Committee have thought it best to make copious extracts from those Reports, instead of offering their own views and opinions.

Although the primary object of the Institute, in originating these periodical displays of domestic productions, has been the promotion of the manufacturing prosperity of the community, it is a source of gratification to find that public favour has rendered them productive of pecuniary benefit; the profits to the Institute, on the present occasion, have been greater than was ever before realized, notwithstanding the heavy expenses incurred in making preparations.

The following awards of Premiums and Honorary Notice have been made in accordance with the recommendations of the Judges, except in a few cases where the Judges neglected to act, or omitted to notice some deserving specimens. In these cases, the Committee on Premiums have awarded such premiums as, in their opinion, were equitable.

Cotton Goods.

To Jacob Dunnell, Pawtucket, R. I., for specimen No. 206, 9 pieces of Chintz, in imitation of the French, deposited by Fales, Lothrop & Co.
Silver Medal.

To the Rockford Cotton Factory, near Wilmington, Delaware, for specimen No. 445, 20 pieces of Long Cloths, deposited by Jos. Bancroft.
Silver Medal.

To Jacob Dunnell, Pawtucket R. I., for specimen No. 69, 6 pieces coloured prints, deposited by Wells & Dunlop.
Certificate of Honorable Mention.

To P. Allen & Son, Providence, R. I., for specimen No. 73, 5 pieces Furniture Chintz, 165¾ yards, deposited by A. &. G. Ralston.
Certificate of Honorable Mention.

To the Hamilton Manufacturing Company, Lowell, Massachusetts, for specimen No. 511, 1 piece Canton Flannel, deposited by David S. Brown.
Certificate of Honorable Mention.

To the Merrimack Manufacturing Company, Lowell, Mass., for specimen No. 189, 17 pieces Merrimack Prints, deposited by David S. Brown.
Certificate of Honourable Mention.

To the American Manufacturing Company, Lowell, Mass., 8 pieces American Prints, deposited by David S. Brown.
Certificate of Honourable Mention.

To A. Robeson, Fall River, Mass., for specimen No. 197, 21 pieces Chintzes, deposited by Hacker, Lea & Co.
Certificate of Honourable Mention.

To Sands Olcott, New Hope, Pa., for specimen of Flax, prepared for spinning on cotton machinery. Certificate of Honourable Mention.

Woolen Goods.

To the Middlesex Manufacturing Company, Lowell, Mass., for specimen No. 253, 9 pieces Cassimeres, deposited by David S. Brown.
Silver Medal.

To the Mechanics' Manufacturing Company, Rochester, N. H., for specimen No. 324, 10 pieces Whitney Blankets, deposited by D. S. Brown
Silver Medal.

To the Bristol Manufacturing Company, Connecticut, for specimen Nos. 139 and 140, 2 pieces Black Satinet, deposited by B. Hindman & Co.
Certificate of Honourable Mention.

To the Minot Manufacturing Company, Enfield, Mass., for specimen No 254, 4 pieces Satinets, deposited by David S. Brown.
Certificate of Honourable Mention.

To J. & J. Eddey, Fall River, Mass., for specimen No. 486, 6 pieces Satinets, deposited by Farnum, Newhall & Bettle.
Certificate of Honourable Mention.

To Zachariah Allen, Providence, R. I., for specimen No. 270, 1 piece Brown Broadcloth, deposited by C. C. Haven & Co.
Certificate of Honourable Mention.

To E. Wrigley, Philadelphia, for specimen No. 520, 2 pieces Drab Cloth.
Certificate of Honourable Mention.

To the New England Worsted Manufacturing Company, Framingham, Mass., for specimens No. 66, 5 pieces White, and No. 67, 5 pieces Green, Kerseys, deposited by Phipps, Heberton & Abbot.
Certificate of Honourable Mention.

To the Mechanics' Manufacturing Company, Rochester, N. H., for specimens Nos. 274 and 275, 5 pieces Bed Blankets, deposited by C. C. Haven & Co. Certificate of Honourable Mention.

Carpets.

To Caspar Rehn, Philadelphia, for specimen No. 531, 1 piece Carpet deposited by William L. Rehn. Certificate of Honourable Mention.

Silks.

To the Philadelphia Silk Culture and Manufacturing Company, E. O. Abbot, Agent, for specimen No. 179, 2 bundles Sewing Silk, deposited by J. C. Kempton. Silver Medal.

To Edward F. Gay, Philadelphia, for display of Manufactured Silks and Silk Machinery. Certificate of Honourable Mention.

To Jonathan Dennis, jr. Portsmouth, R. I., for specimen No. 176, Silk Spinning and specimen of Silk. Certificate of Honourable Mention.

To Miss Gertrude Rapp, Economy, Pa., for specimens Nos. 24, 25, 26 and 27, Black and Figured Satin Vestings, deposited by Paul Moody. Certificate of Honourable Mention.

Straw Goods.

To Thomas White, Philadelphia, for specimen No. 89, 8 Straw Bonnets. Silver Medal.

Surgical Instruments and Dentistry.

To P. Madeira, Philadelphia, for specimens Nos. 190 and 191, an assortment of Surgical and Dental Instruments. Certificate of Honourable Mention.

Messrs. Wiegand & Snowden also exhibited a variety of Surgical Instruments of their usual excellence, but they can receive no award, as Mr. Wiegand is a Manager of the Institute.

To S. W. Stockton, Philadelphia, for specimen No. 149, 2 cases Incorruptible Teeth. Certificate of Honourable Mention.

Iron and Steel.

To A. Denslow, Hartford, Conn., for specimen No. 848, 5 bundles Iron Wire, made from American Iron, deposited by E. J. Etting. Silver Medal.

To J. C. Bryant & Co., Manayunk, for specimen of Iron smelted with Anthracite. Silver Medal.

To Valentine, Harris & Co., Bellefonte, Pa., for specimen No. 91, Lot of Iron and Iron Ore, deposited by E. J. Etting. Certificate of Honourable Mention.

To James Wood & Sons, Philadelphia, for specimen No. 194, 2 bundles Sheet Iron. Certificate of Honourable Mention.

To the Mastic Iron Works, Lancaster county, Pa., for specimen No. 725, 10 bars of Iron. Certificate of Honourable Mention.

To J. Washburn, Worcester, Mass., for specimen No. 707, Card Wire made from foreign Iron. Certificate of Honourable Mention.

Cutlery.

To Rochus Heinisch, Newark, N. J., for specimen No. 327, 12 pairs Tailors' Shears, deposited by Charles Harkness. Silver Medal.

Copper and Brass.

To Crocker, Brother & Co., Taunton, Mass., for specimens No. 283, 2 sheets Zinc, and No. 284, 3 sheets Copper, deposited by A. W. Metcalf & Co. Certificate of Honourable Mention.

Hardware and Edge Tools.

To William Rowland, Philadelphia, for specimen No. 34, 1 case Mill Saws. Silver Medal.

To Hill & Winship, Amherst, Mass., for specimen No. 138, 1 lot of Planes, deposited by Joseph P. Hornor & Son. Silver Medal.

To Day, Newell & Day, New York, for specimen No. 495, 5 Locks. Silver Medal.

To Rockwell & Hinsdale, Winchester, Connecticut, for specimen No. 130, 4 Corn Scythes, deposited by Wm. Hart Carr & Co.
Certificate of Honourable Mention.

To Hale, Whipple & Waters, Millbury, Mass., for specimen No. 293, 5 Scythes. Certificate of Honourable Mention.

To Hamen Chapin, New Hartford, Conn., for specimen No. 124, 1 case Carpenters' Planes, deposited by Beckley & Shipman.
Certificate of Honourable Mention.

To John Colton, Philadelphia, for specimens Nos. 343, 344 ,345, and 544, an assortment of Planes. Certificate of Honourable Mention.

To Israel White, Philadelphia, for specimen No. 688, 16 Bead Planes.
Certificate of Honourable Menton .

To E. W. Carpenter, Lancaster, Pa., for specimen No. 513, 5 Planes, assorted. Certificate of Honourable Mention.

The Planes deposited by several other makers were good articles, but the number deposited by any one manufacturer were too small to entitle them to a certificate.

To James Wood & Sons, Philadelphia, for specimen No. 194, samples of Saws. Certificate of Honourable Mention.

To Aaron Nichols, Philadelphia, for specimen No. 286, Circular Saws, deposited by A. W. Metcalf & Co. Certificate of Honourable Mention.

To Savary, Shaw & Co., Philadelphia, for specimen No. 9, Hollow Ware.
Certificate of Honourable Mention.

To Baily & Putnam, Malden, Mass., for specimen No. 282, an assortment of Britannia Ware. Certificate of Honourable Mention.

To Leonard, Reed & Barton, Taunton, Mass., for specimen No. 766, an assortment of Britannia Ware. Certificate of Honourable Mention.

To William Beatty & Son, Springfield, Delaware county, for specimens Nos. 1 to 8, and 59 to 65, 2 lots of Edge Tools, deposited by J. B. Baxter & Son, and Smith & Brothers. Certificate of Honourable Mention.

To John Beatty, Philadelphia, for specimens Nos. 41 to 58, lot of Edge Tools. Certificate of Honourable Mention.

To the Douglass Axe Manufacturing Company, East Douglass, Mass., for specimens Nos. 97 to 108, lot of Axes and Hatchets, deposited by W. H. Carr & Co. Certificate of Honourable Mention.

To D. Simmons & Co., Cohoes and Trenton, N. J., for specimen No. 401, 1 case Edge Tools, deposited by Curtis & Hand.
Certificate of Honourable Mention.

To the Taunton Manufacturing Company, Mass., for specimen No. 437, 6 pieces Edge Tools, deposited by Moore, Heyl & Co.
Certificate of Honourable Mention.

To D. C. Stone & Co., Naponock, N. Y., for specimen No. 453, 11 pieces Edge Tools, deposited by William H. Carr & Co.
Certificate of Honourable Mention.

To Collins & Co., Ulster county, N. Y., for specimen No. 526, 2 boxes of Axes, deposited by Samuel Rogers. Certificate of Honourable Mention.

To Moses Bates, jr., East Bridgewater, Mass., for specimen No. 469, 1 case Shoemaker's Tools, deposited by W. H. Carr & Co.
Certificate of Honourable Mention.

To T. J. & S. Kane, New York, for specimen No. 657, 1 Rack Vice.
Certificate of Honourable Mention.

To E. Brady, New York, for specimen No. 196, Smiths' Vices.
Certificate of Honourable Mention.

To Blake & Brothers, New Haven, Conn., for specimen No. 377, Locks and Latches, deposited by Curtis & Hand.
Certificate of Honourable Mention.

To Augustus Prutzman, Philadelphia, for specimen No. 419, 5 Locks.
Certificate of Honourable Mention.

To Joseph Nock, Philadelphia, for specimen No. 636, Trunk Locks, and Padlocks. Certificate of Honourable Mention.

To Wm. Heywood, Philadelphia, for specimen No. 455, 1 Bank Lock.
Certificate of Honourable Mention.

To the Nashua Lock Co., Nashua, N. H., for specimen No. 334, 1 Mortise Lock. Certificate of Honourable Mention.

To D. Adams & Co., Springfield, Vermont, for specimen No. 79, 5 reams Sand Paper. Certificate of Honourable Mention.

Messrs. Wm. Hart Carr & Co.'s improved Hay Forks, &c., so highly praised by the Judges, cannot receive a premium, as Mr. Carr is a member of the Board of Managers.

Silver Ware and Jewelry.

To James Thomson, New York, for specimen No. 461, samples of Silver Ware. Certificate of Honourable Mention.

To Jacob Bennett, Philadelphia, for specimen No. 65, Silver Writing Apparatus. Certificate of Honourable Mention.

To Samuel Kirk, Baltimore, for specimen No. 720, Silver Tea Service.
Certificate of Honourable Mention.

The Silver Ware exhibited by Messrs. Fletcher & Bennett, of this city, was deemed fully equal, in beauty and quality, to the specimens above noticed, but they are excluded from any award, in consequence of Mr. Fletcher being an officer of the Institute.

To J. J. Lowndes, Philadelphia, for specimen No. 759, Gold Pencils.
Certificate of Honourable Mention.

To W. J. Mullin, New York, for specimens No. 577 and 724, Gold Watch Dials. Certificate of Honourable Mention.

Stoves and Grates.

To E. Barrow, Philadelphia, for specimen No. 540, one Cooking Range.
Silver Medal.

To H. & F. Stimson, Boston, for specimen No. 159, Cooking Range.
Certificate of Honourable Mention.

To Auld & Cox, Philadelphia, for specimen No. 433, Cook Stove, deposited by Charles M'Neall. Certificate of Honourable Mention.

To Josiah Kisterbock, Philadelphia, for specimen No. 513, 2 Cook Stoves.
Certificate of Honourable Mention.

To Josiah Kirk, Philadelphia, for specimen No. 514, Cook Stove.
Certificate of Honourable Mention.

Philosophical Apparatus.

To Amasa Holcomb, Southwick, Mass., for specimen No. 409, a Reflecting Telescope. Silver Medal.

To Joseph Saxton, Philadelphia, for specimen No. 182, Balance for Adjustment of Weight at United States Mint. Silver Medal.

To Henry F. Piaget, of New York, for specimen No. 591, Pocket Watch with Double Power Movement. Silver Medal.

To Edmund Draper, Philadelphia, for specimen No. 213, two Theodolites. Certificate of Honourable Mention.

To W. J. Young, Philadelphia, for specimen No. 347, 2 Surveyors' Compasses. Certificate of Honourable Mention.

To Archibald Little, Camden, N. J., for specimen No. 752, Chronometer with his patent Escapement. Certificate of Honourable Mention.

To Alva Mason, Philadelphia, for specimen No. 222, assortment of Philosophical Apparatus. Certificate of Honourable Mention.

Guns.

To William Jenks, Chickopee Falls, Mass., for specimen No. 160, Rifle, loading at Breech. Silver Medal.

To W. Lovering & Co., Taunton, Mass., for specimen No. 288, rotary barrel Pistols. Certificate of Honourable Mention.

To the Patent Arms Manufactory, Paterson, N. J., for specimen No. 518, Guns, Rifles and Pistols. Certificate of Honourable Mention.

Models and Machinery.

To James Brooks, Philadelphia, for specimen No. 679, Locomotive Engine of improved construction. Silver Medal.

To Gaskell & Copper, Philadelphia, for specimen No. 478, Book Binders' Tools. Silver Medal.

To William M. Hartshorne, Philadelphia, for specimen No. 631, Stationary Engine. Certificate of Honourable Mention.

To M. W. & T. Greer, Philadelphia, for specimen No. 829, Steam Engine. Certificate of Honourable Mention.

To Moses Starr & Son, Philadelphia, for specimen No. 880, small Tubular Boiler. Certificate of Honourable Mention.

To E. D. Marshall, Philadelphia, for specimen No. 634, one Slide Rest. Certificate of Honourable Mention.

To N. Moore, Ellsworth, Me., for specimen No. 330, Stave Cutting Machine. Certificate of Honourable Mention.

To Joel Bates, Philadelphia, for specimen No. 632, Fire Engine. Certificate of Honourable Mention.

The Fire Engine made by Mr. Agnew was much admired, but is not permitted to compete for premiums by the rule which excludes Managers of the Institute from awards.

To J. Smith & Co., Philadelphia, for specimen No. 365, Machine for Sticking Cards. Certificate of Honourable Mention.

To L. J. Pope, Boston, for specimen No. 703, Shears for clipping Iron. Certificate of Honourable Mention.

Lamps and Gas Fixtures.

To C. Cornelius & Son, Philadelphia, for specimen No. 680, display of Chandeliers and Gas Fixtures. Silver Medal.

To Whelan & Brown, Philadelphia, for specimen No. 458, six pairs of Gas Fixtures. Certificate of Honourable Mention.

Musical Instruments.

To Gilbert & Co., Boston, for specimen No. 522, Horizontal Piano. Silver Medal.

To Alexander Kirkwood, Philadelphia, for specimen No. 584, one Harp. Certificate of Honourable Mention.

To Jacob Pfaff, Philadelphia, for specimen No. 521, one Flute.
Certificate of Honourable Mention.

To C. H. Eisenbrandt, Baltimore, for specimen No. 482, several Flutes and Horns. Certificate of Honourable Mention.

China and Glassware.

To George Dummer, New York, for specimen No. 337, 4 pair Fluted Decanters, deposited by E. E. Smith & E. Douglass. Silver Medal.

To the Boston and Sandwich Glass Company, for specimen No. 174, lot of Glassware, deposited by Joseph Kerr.
Certificate of Honourable Mention.

To the Redford Glass Company, New York, for specimen No. 611, one box of Crown Glass, deposited by Wm. M. Muzzy.
Certificate of Honourable Mention.

Marble.

To Findley Highlands, Philadelphia, for specimen No. 585, 2 Marble Mantels. Certificate of Honourable Mention.

To T. W. Burchell, Philadelphia, for specimen No. 582, 2 Marble Mantels, and 1 Centre Table. Certificate of Honourable Mention.

To Henry C. Webb, Philadelphia, for specimen No. 448, 1 Marble Mantel, and 2 Statuary Tables. Certificate of Honourable Mention.

To Vanderbilt & Wildes, Philadelphia, for specimen Nos. 578 and 615, 2 Marble Mantels, and 1 Egyptian Marble Table.
Certificate of Honourable Mention.

To John Hill, Philadelphia, for specimen No. 595, a Tablet for the tomb of Joseph S. Lewis, Esq. Certificate of Honourable Mention.

To W. Struthers, Philadelphia, for specimen No. 595, a Dial Stand of Italian Marble. Certificate of Honourable Mention.

Mr. John Struthers being a member of the Board of Managers, no award can be made for the Mantels exhibited by him.

Cabinet Ware.

To the Journeymen Cabinet Makers' Society, Philadelphia, for specimen No. 483, &c., an assortment of Cabinet Ware, deposited by Crawford Riddel. Silver Medal.

To John George, Philadelphia, for specimen No. 410, 6 pieces Hair Cloth Seating. Certificate of Honourable Mention.

To N. M'Graw, New York, for specimen No. 625, 1 Sofa Bedstead.
Certificate of Honourable Mention.

To William Woolley, New York, for specimen No. 741, 1 Invalid, 1 Traveling, and 1 Sideboard Bedstead.
Certificate of Honourable Mention.

To E. J. Cherrington, Boston, Mass., for specimen No. 783, 1 Wardrobe Bedstead. Certificate of Honourable Mention.

Leather and Manufactures of Leather.

To Robert Carey, Philadelphia, for specimen No. 353, 2 setts single Harness. Silver Medal.

To John P. Alberger, Philadelphia, for specimen No. 113, two Leather Trunks. Certificate of Honourable Mention.

To A. L. Hickey, Philadelphia, for specimen No. 145, 3 Patent Leather Trunks. Certificate of Honourable Mention.

To John Migeod, Philadelphia, for specimen No. 306, 1 Patent Leather Trunk. Certificate of Honourable Mention.

To Mogridge, Boustead & Co., Philadelphia, for specimens No. 303, 1 doz. Russet Calf Skins, and No. 304, 12 sides Bridle Leather. Certificate of Honourable Mention.

To Doyle & M'Neilly, Philadelphia, for specimen No. 391, lot of Buckskins for Pianos. Certificate of Honourable Mention.

To John Lippincott, Philadelphia, for specimen No. 118, Chaise Hides. Certificate of Honourable Mention.

To W. & D. Lowber, Philadelphia, for specimen No. 308, samples of Chaise Hides, Certificate of Honourable Mention.

To Benjamin Shaw, New York, for specimen No. 515, Ladies' Boots. Certificate of Honourable Mention.

To Wm. Bird, Philadelphia, for specimen No. 398, Mens' Boots. Certificate of Honourable Mention.

Combs and Brushes.

To Benjamin Taylor, Philadelphia, for specimen No. 35, an assortment of Brushes. Certificate of Honourable Mention.

To G. W. Morris, Philadelphia, for specimen No. 302, 1 case of Brushes. Certificate of Honourable Mention.

To Myers Busch, Philadelphia, for specimen No. 351, a case of Brushes. Certificate of Honourable Mention.

To Charles J. Abel, Philadelphia, for specimen No. 373, a lot of Brushes. Certificate of Honourable Mention.

Books and Stationary.

To Hogan & Thompson, Philadelphia, for specimen No. 382, a lot of Books and Stationary. Silver Medal.

To Jessup & Brothers, Philadelphia, for specimen No. 85, 4 reams Paper. Silver Medal.

To the Pennsylvania Slate Company, Easton, Northampton county, for specimen No. 154, a lot of School Slates. Certificate of Honourable Mention.

To Josiah Loring, Boston, Mass., for specimen No. 258, a lot of Globes. deposited by Hogan & Thompson. Certificate of Honourable Mention.

To W. J. Abel, Philadelphia, for specimen No. 412, Book Binding. Certificate of Honourable Mention.

To Jos. Pitmackey, Philadelphia, for specimen No. 454, 1 Portfolio. Certificate of Honourable Mention.

Fine Arts.

To M. S. Parker, Philadelphia, for specimen No. 88, 1 Painting. Silver Medal.

To John Sartain, Philadelphia, for specimen No. 164, 2 frames—Mezzotinto Engravings. Silver Medal.

To Rembrandt Peale, for Portrait of Chief Justice Marshall. Certificate of Honourable Mention.

To Thomas Birch, Philadelphia, for specimen No. 93, 2 Marine Paintings. Certificate of Honourable Mention.

To John Haviland, Philadelphia, for specimen No. 715, Architectural Drawings. Certificate of Honourable Mention.

To John Gibson, Philadelphia, for specimen No. 414, 20 Imitations of Woods and Marbles. Certificate of Honourable Mention.

To W. B. M'Murtrie, Philadelphia, for specimen No. 481, 3 Paintings. Certificate of Honourable Mention.

To N. Monachesi, Philadelphia, for specimen No. 532, Painting of Charity. Certificate of Honourable Mention.

To Miss R. Sully, Philadelphia, for specimen No. 648, 4 Landscape Paintings. Certificate of Honourable Mention.

Fancy Articles.

To the Roxbury India Rubber Company, Boston, for specimen No. 266, Caoutchouc Cloths, deposited by J. Thornley & B. G. Mitchell. Silver Medal.

To the Pennsylvania Institution for the Blind, Philadelphia, for specimen No. 346, 24 pieces, deposited by J. R. Friedlander. Silver Medal.

To Miss S. W. Horn, Philadelphia, for specimen No. 389, 2 Shell Vases of Wax Flowers. Certificate of Honourable Mention.

To John Skirving, Philadelphia, for specimen of Scagliola. Certificate of Honourable Mention.

To Mrs. Bennett Fling, Philadelphia, for specimen No. 52, Shell and Wax Flowers and Fruit. Certificate of Honourable Mention.

To Mary Pastorius, Philadelphia, for specimen No. 814, 1 worsted Lamp Stand. Certificate of Honourable Mention.

To Louisa Miller,,Philadelphia, for specimen No. 820, 1 Lamp Stand. Certificate of Honourable Mention.

Umbrellas.

To W. & W. H. Richardson, Philadelphia, for specimen No. 599, samples of Umbrellas. Certificate of Honourable Mention.

To W. A. Drown, Philadelphia, for specimen No. 119, a lot of Umbrellas. Certificate of Honourable Mention.

To Edwin Sleeper, Philadelphia, for specimen No. 245, Portable Umbrellas. Certificate of Honourable Mention.

Coach Making.

To Ogle & Watson, Philadelphia, for specimen No. 571, 1 Coach and 1 Buggy. Silver Medal.

To George Dunn, Newark, N. J., for specimen No. 706, Buggy Railing and Dasher. Certificate of Honourable Mention.

JOHN C. CRESSON,
WILLIAM H. KEATING,
ALEXANDER FERGUSON,
THOMAS FLETCHER,
ISAAC B. GARRIGUES,
ALEXANDER M'CLURG,
JOHN S. WARNER,
JOHN AGNEW,
WILLIAM H. CARR,
HENRY TROTH,
SAMUEL V. MERRICK,
ROBERT M. PATTERSON,
Committee on Premiums and Exhibitions.

EXTRACTS FROM THE JUDGES' REPORTS.

Report on Cotton Goods.

The Committee observe that the specimens coming under their inspection appear to have been selected from stocks remaining on hand from fall sales, now exceedingly low, and not to have been manufactured with a view to the Exhibition. Individually, in the pursuit of our ordinary business, we daily see manufactures of Cotton, at least equal, and some superior, to many of the articles exhibited; this, however, so far from detracting from the merit of the manufacturers, speaks highly in their favour. It shows that what formerly was exhibited as a curiosity, has now become a large and essential branch of the manufactures of the country, and is no longer looked upon with astonishment. The progress and improvement in substantial and serviceable goods, are very great, and in printed Cottons much excellence is attained; but while we congratulate ourselves on this result, we must not be blind to the fact, that much remains to be done. In the finer fabrics there has been but little attempted, and a wide field is open, as yet scarcely touched, among Cambrics, Jaconets, Mulls, Books, and the various kinds of light and fine texture goods. The variety of specimens exhibited was less than on former occasions.

Report on Woolen Goods.

The Committee take pleasure in saying that the samples submitted are generally entitled to commendation; the Cloths are well made, the colours good, and the finish of some of them very beautiful. Those samples which most particularly attracted the notice of the Committee were No. 270, a piece of Brown, and No. 520, 2 pieces of Drabs; perhaps 2 pieces of Drabs of lot No. 380, may be classed with them.

9 pieces of Cassimeres, No. 253, are entitled to praise; some pieces in this lot deserve very high commendation for colour, make, and finish.

The Satinets fully sustain the reputation which our manufacturers have heretofore acquired in producing this most useful article. Nos. 139, 254, and 486, are worthy of high praise both for excellence of material and skill in manufacturing. Nos. 140 and 141 are also excellent goods.

The samples of Blankets have been examined with peculiar interest and pleasure, particularly Nos. 256 and 324. Also a lot of cotton warp Blankets, which combine warmth with lightness, and appear to the Committee to be adapted to most of the purposes for which the woolen blanket is used.

Nos. 66 and 67, two excellent samples of Kerseys.

Report on Carpeting.

The Committee express with reluctance their unanimous opinion that no specimens of the Carpets, Floor Cloths, or Rugs, offered to their notice, surpass in excellence those in former Exhibitions, whilst in variety, style, and fabric, they fall far short of many patterns made in this country, and which, for the credit of American manufactures, it would have been well to have had exhibited on this occasion. The Committee are of opinion that the exhibitors have not brought forward their best specimens, and that due allowance must be made for the short notice given of the intended Exhibition, by reason of which they, and others, were prevented furnishing a more creditable display. No branch of American industry is likely to be more extensively patronized in the United States than that of making Carpeting and

Floor Cloths, the consumption of which is rapidly and widely extending. But whilst public opinion still leans in favour of imported goods, on account of early and well founded prejudices against those made in this country, owing to their greasy and imperfect character, and the many deceptions practised on those who were inclined to favour American ingenuity, it is but fair to state our united conviction that these articles can be, and are now, made in this country equal, if not, in some respects, superior, to those imported; and at our next exhibition it is to be hoped the public may have more ample proof of what can be done in this important and elegant branch of domestic industry.

Report on Silk and Lace Goods.

In performance of the duty assigned them, the Committee availed themselves of the valuable aid of Godfrey Weber, Esq., a gentleman whose long experience in the production and manufacture of Silk, entitles his opinion to great weight.

The Sewing Silks are very good; the Philadelphia article we consider entitled to the highest reputation, from its strength, evenness and colour. The Northampton is very beautiful, but rather deficient in strength. The Silk manufactured in Germantown we do not think equal to either of the descriptions above mentioned.

The specimens offered by Gertrude Rapp are worthy of all praise; the Black Silk Handkerchiefs (Cravats) are admirable, approaching closely in appearance to the Italian article. The Black Satin Vestings are highly creditable; the Figured Satin Vestings are deserving of praise, as fair imitations of the French article; this remark particularly applies to the small figure.

The White and White Printed Border Handkerchiefs, as also the Red Handkerchiefs, are very fair imitations of the English article.

The samples of Silk woven by E. F. Gay, are deserving of notice, the Gros de Tour is remarkably pretty, although too much Silk is employed to render the article profitable.

The cocoons vary greatly, the same lots embracing middling and superior qualities; those from S. Griffith and Sister are remarkable from the circumstance of their having been produced from the common black mulberry; it would be desirable in all instances to ascertain from what trees the cocoons are produced.

The Reeled Silk is equal in quality to the French or Italian; it is, however, unevenly reeled, mostly being single thread; for Sewing Silk it should be reeled from No. 18 to 20.

Report on Iron and Steel.

The Committee offer the following remarks upon the several articles which came under their notice.

A lot of Iron, manufactured by Valentine, Harris & Co., from the pig metal made at the Howard Furnace. The large round Iron, from the trials made, appears very good, and we think it would be better for the axles of rail-road cars, and other purposes requiring strength, than the English refined Iron, as it is much stiffer, and nearly as tough: the small round Iron from the same makers is also very good. The Slit Rods also, on trial, appeared to be of good quality.

Samples of Bar Iron, from the Martick Works, deposited by James Row-

land: the bars are beautifully hammered, and the Iron of good quality. If the forge masters in Pennsylvania could be induced to trim the fag ends of the bars, the same as the foreign Iron, it would be duly appreciated by all the workers in Iron, and make the article unexceptionable.

Blistered Steel, deposited by James Rowland, from the Kensington Furnace: a pretty good article, made from American Iron, but we do not consider it superior to samples that have been exhibited on a former occasion by the same gentlemen.

Some specimens of rolled and hammered Iron, made with coke, by Peter Ritner, the samples being so small, the Committee could not give them a fair trial, and therefore are not willing to express any opinion of the quality of the Iron.

Some Boiler Rivets, made by Canning & Co., of Troy, N. J., from the Howard Furnace Iron, said by those that have used them to be a very good article.

Specimens of Horse Shoes, Spikes, &c., made by machinery at the Troy Manufacturing Company's Works: the Horse Shoes especially appear to be well made, and the Iron good.

Specimens of Pig Iron from the Furnace, and also of the ore from which the Iron was made: the Committee cannot express a positive opinion of the quality of either of them, from mere inspection, no other means being at their disposal, although the appearance is certainly favourable.

Samples of Pig Iron made with anthracite coal, by Isaac C. Bryant & Co.: the same remarks will apply to these as to the preceding, and the Committee trust that the gentlemen engaged in this enterprise will persevere until they accomplish what they desire.

A Tuyere for a hot blast furnace, made by Savery Shaw & Co., Philadelphia, differing somewhat in form from, and allowed by those who have given them a trial to be preferable to, those in general use in Pennsylvania.

A quantity of Wire made by A. Denslow, from Juniata Iron, which is decidedly the best Wire, as to strength and appearance, the Committee have ever seen made from American Iron.

Report on Hardware and Edge Tools.

The Committee express their gratification at the general improvement in all the articles displayed. They notice particularly the Edge Tools made by William Beatty & Son; John Beatty; D. Simmons & Co.; Hunt & Co.; Taunton Manufacturing Company; Collins & Co., New York; and D. Stone. These are all of decidedly good shape and finish, and the Committee, where all were so good, found great difficulty in deciding as to the superiority of either. The Axes from Collins & Co. were all made in ten hours by one man; the Tools from Simmons & Co. and Hunt & Co. were not intended for exhibition: the others we believe were.

The Committee unanimously agree that the Saws from William Rowland are decidedly superior to any others ever exhibited.

The Forks from William H. Carr & Co. deserve more than a passing notice; the numerous improvements shewn by the samples must be apparent to every dealer in the article; the malleable cap for Hay Forks is an invention of Mr. Carr's; for this and the neat manner in which all are put together, we think Mr. Carr deserves the particular notice of the Institute.

A case of Cotton and Wool Cards; 1 of Tacks and Brads, from A. Field & Co.; box of Glue, and box of Coffee Mills: all good.

The Coffee Mills of Rittenhouse, a superior article, and the best exhibited.

Corn and Grass Scythes, from Rockwell & Hinsdale; ditto from Newton Darling; ditto from Hale, Whipple & Waters—all superior and much improved since last Exhibition.

Locks and Latches from Blake & Brother; good, and in great variety. Bank Lock by Wm. Heywood; good, and very strong. Locks by A. Prutzman, and by Jos. Nock; very ingenious in construction, and good. Trunk Locks by Jos. Nock, a new article, patented by the maker, the safest Lock of the kind known.

Locks and Butts, brass plated, from Rogers & Co., superior. Italian Iron, by Prutzman, good. A case of Locks from Day, Newell & Day, of New York, very safe, and, for finish and construction, the finest ever exhibited.

A Mortise Lock and Latch from the Nashua Lock Company; the simplicity of these articles, and their cheapness and durability, recommend them to particular attention.

Chisels from Russel, very creditable to the maker.

Case of Shoemakers' Tools, by M. Bates, best ever exhibited.

Vice, with Rack,
" with horizontal line screw, } Good improvements.

5 reams Sand Paper, from the experience of a number of our best mechanics, the best paper known.

Upper and lower Sash Springs and Fasteners; these attracted considerable attention, and are decidedly superior to any thing of the kind in use.

Aikin's patent Saw Setts; good articles, and very ingenious.

Report on Stoves and Grates.

The Committee were much gratified with seeing that so many, and such a variety, of specimens had been brought forward.

Of the Parlour Grates, there were some of very handsome patterns and good workmanship.

Kitchen Grates, or Ranges: there were two exhibited, completely and handsomely put up, in full operation, almost daily: both are well adapted for performing much work for the quantity of fuel consumed. The one by E. Barrows, of Philadelphia, has a boiler and baker in each side, and an oven in the back; the fire is contained in a cast iron cylinder, in front of which a large tin kitchen may be placed for roasting. Price, with all the necessary apparatus, put up complete, is $60. The fire being in a cylinder, a very small quantity of coal is necessary, and that of the cheaper kind, as nut coal, does well.

The other Range was from H. & F. Stimpson, of Boston; the fixtures are simple, easily understood and managed; boiler on each side; oven above the fire back; the heat may be directed to either or all at pleasure; the coal may be of the cheaper kind, as nut coal; grate open bars, and promises to be durable. The makers have three sizes, Nos. 1, 2, and 3, which are offered at $24, $34, and $40. Cost of putting up from $15 to $18. The smallest size, or No. 1, was exhibited; our citizens show a disposition to test its merits, as 100 are about being put up in this city.

Of Cooking Stoves for coal as fuel, there was a great variety; most of them were found to answer the purpose of the common 9 plated stove; the prices, sizes, and fashion are various, to suit the fancy of different persons

The Committee are much pleased to see the continual improvements making in castings of stoves, to obviate the necessity of wrought iron hinges, latches, &c., which makes them more durable, and at less cost, thereby increasing the comfort of even the poorest families, for the cost is so small, they are within the reach of all, and well adapted to the use of the lowest price small coal.

The Close Stoves, made of Russia sheet iron, for the warming of Parlours and Halls, such as the Olmsted, by S. Loyd; the 4 column Radiator, by Gleason, and others, are all very good, as the public will find by the use of them, that their houses may be warmed by them with less than half the coal consumed in open grates to give the same heat.

Report on Models and Machinery.

In so numerous a collection it was to be expected that many would be found possessing little interest either in the principles of their construction, or mode of application; the Committee, however, are happy to have it in their power to say that the proportion of such contained in the present display was unusually small, whilst, on the contrary, a number of machines of admirable execution, when the workmanship is considered, and great efficiency as it regards their operation, were before the public.

We have much pleasure in noticing the Locomotive Engine of Mr. Brooks: simplicity, compactness, and strength are united in an eminent degree in this Engine; the cylinder guide, one of its distinctive features, appears to your Committee to be particularly applicable in this instance from its strength, and the protection which it affords to the wearing surfaces from dirt; the strong and compact manner in which the pump plunger is appended is also worthy of notice; another most important part of this Engine is the means of reversing by a four way cock, and the peculiar and ingenious arrangement of the valves, by means of which this most important operation is rendered certain and rapid in the most desirable degree. In theory, and to the eye, no objection exists to this arrangement; in practice, difficulties may possibly arise, but the ingenuity which is every where displayed in the construction of this excellent engine, is quite adequate to meet them when they shall appear; indeed Mr. Brooks has, subsequently to the examination of the Committee, constructed a model to meet some of the supposed objections, with evident success.

The Committee suggest that the thanks of the Board of Managers are justly due for the careful and efficient manner in which he has supplied steam from the boiler of his Engine for the use of the other Engines and Models.

No. 11, Carriage Boxes, are well made, and worthy of commendation.

Fairbanks', and other, Counter Scales are well contrived and executed.

The models of Steam Engines, several of which were exhibited, are well executed, some of them remarkably so; they added materially to the interest of the Exhibition, and will form an excellent record of the progress of steam invention, especially if they could be collected and preserved in the rooms of the Institute.

The Spark Extinguishers for Locomotives, several of which were exhibited, need experimental trial; some are very simple, but the difficulty which is inherent in this desirable object, (the checking of the draft) does not appear to be overcome in any.

The Tailors' Measuring Machine, No. 144, has had a careful examination; by its aid a perfect fit could unquestionably be made, and it presents some

fixed principles by which certain distances, depths and curves, could be accurately measured. A skilful workman appears necessary to its employment; how far the same desirable result (a good fit) could be accomplished by the same hand, with simple tools, the Committee has not sufficient knowledge of the art to pronounce.

The Silk Reeling and Twisting Machines appear to your Committee to be important steps in the Silk manufacture. In the present state of their knowledge, they cannot speak of comparative efficiency or novelty in these particular machines, but they consider the advancement of this portion of our infant manufactures of the utmost importance, and recommend the subject to special favour.

It is within our memory that the cheap and good cottons of these States have taken exclusively the Eastern markets, from whence they were formerly supplied,—is it not probable that the same ingenuity applied to the manufacture of Silk, may produce a like result?

The Tailors' Shears patented and manufactured by R. Heinisch, deposited by Mr. Hawkins, are beautifully made, exhibiting, in the successive specimens, gradual improvement to a perfect fit to the hand, and a judicious disposition of the leverage; the Committee consider that a great benefit has been conferred on a large class of operatives by the improvement of an article in incessant use, and therefore recommend these Shears to special notice.

The Planing Machine, No. 331, is entitled to favourable notice; the manner in which the cutters are arranged is adapted to produce a smooth surface and a straight cut, and there are besides several ingenious modes of aiding the operation of the machine. The Committee are not sufficiently informed of the merits of other machines to report as fully on this as they would be otherwise induced to do; but it certainly possesses several important points of advantage.

The Fire Engines by Messrs. Merrick & Agnew, and Mr. Bates, are exceedingly beautiful, and quite well made; the former is of superior workmanship, and the ornaments are in good keeping.

Several very neat and well finished Steam Engines, of various powers, were exhibited; that made by Wm. M. Hartshorne, and employed, during the Exhibition, as the motive power for the various machines, was efficient and very useful; the thanks of the Committee would be well tendered to the maker.

Messrs. Sellers & Sons also deserve favourable mention for a handsome small Engine; but it is particularly due to Messrs. T. & M. Greer, to observe that their small horizontal Engine was remarkable for its simplicity, the guide and pump being combined, and also for its excellence of workmanship, being the neatest and most compact Engine yet presented. It possesses also additional interest from its being supplied with a tubular boiler.

The models of Row Boats are exquisitely beautiful in form, and of the utmost excellence of workmanship. This art appears, from these samples, to have reached its utmost point of excellence.

The Lathe and Slide Rest made by E. D. Marshall, is an excellent piece of workmanship, and in every part is well arranged and finished.

A number of machines were exhibited, which are not in the list furnished to your Committee, some of which are entitled to favourable notice. These machines were probably too late to be entered for examination, according to the regulations.

The Committee, however, take the liberty of appending to their report a notice of the following:

The Stave Cutting Machine by L. Lombard, was evidently efficient, rapid, and likely to be useful as a labour-saving and economical machine.

The Mortising Machine of Mr. Tompkins, is also worthy of commendation.

The Stave Sawing Machine of Mr. Moore, was also of particular interest, from its ingenious construction and adaptation to produce good work. It is worthy of special notice.

The Straw Cutter of Mr. Green was also of simple and efficient construction; and the Stone Cutting Machine of Messrs. Jno. R. Post & J. Chritcherson is entitled to a favourable notice. The Committee are impressed with the importance of applying machinery to the cutting and dressing of stone, as one of the most important means of saving labour, especially in this State, where so many buildings are in progress, and where architectural taste is of so elevated a character. From the want of knowledge, they cannot judge of the comparative merits of this machine, but they think the object of its construction one of the most important, and worthy of the fullest encouragement.

Report on Lamps and Gas Fittings.

The Committee have great pleasure in saying that many of the articles submitted to their inspection do credit to American skill and workmanship.

The Lamps and Chandeliers of Messrs. Cornelius & Co., are designed and executed in a manner which, for taste and durability, has never been equalled in this country. Their style of bronzing (by a method believed to be new) struck the Committee as greatly superior to any thing of the kind they had ever seen. Some of the articles submitted by the same ingenious manufacturers are handsomely ornamented with etched figures. The Committee are not aware that etching on brass has, until now, ever been practised.

The different articles of Gas Fittings and Burners exhibited, manifest an improvement very creditable, more especially when we consider how recently that branch of manufacture has been introduced into this city. Those by Messrs. Whelan & Brown, although less finished than would be desirable for the parlour, are well adapted to general use. The burners by Mr. Saull are well made, but in a form, and on a principle, not found to be the best. Experience has shown that jets widely separated, besides the serious objection of wasting gas unconsumed, from negligent attendants omitting to apply the flame to each and every orifice, it is in other respects not economical. In all cases, jets should be so arranged (unless where ornament rather than utility is desired,) as to allow the flames to coalesce and form one sheet. By this means a much greater amount of light is obtained for the quantity of gas consumed.

The Gas Fixtures deposited by Mr. Hawksworth, came too late for competition, but are creditable for the smoothness of their workmanship.

The beautiful samples of Iron Gas Tubing, manufactured by Morris, Tasker & Morris, likewise came too late for a premium, though well deserving of it.

Report on Chemicals.

The Chemicals are from the laboratories of John Farr & Co., Wetherill & Brothers, and D. B. Smith & W. Hodgson. These gentlemen have long stood high as scientific chemists. The articles from them in the Exhibition

are deserving of commendation as excellent samples of their kind, but are such as have heretofore been manufactured successfully in this country, with the exception of Hydriotic and Formic Acids, and Sulphate of Manganese, from the last mentioned firm, which the Committee are not aware of having been made before by other American chemists.

The Fancy Soaps from the manufactory of Hyde & Sons, Baltimore, are of excellent qualities; and the Perfumery from the establishment of L. W. Glenn, deserves honorary notice.

The Varnishes from G. S. Clemens looked well, and the Committee have no doubt of their fine qualities, but had no means of effectually testing them.

Report on China and Glassware.

The Committee offer the following remarks upon the various articles submitted:

The samples of China very neat, but similar to that previously exhibited. The Committee regret to say that the manufacture of this article is discontinued.

The variety of Glassware being cut articles of various kinds from the Boston and Sandwich Company, is of a superior quality. The Committee are of opinion that this manufacture cannot be surpassed. The articles were of every day use, and deserve great commendation.

No. 203. The Stone Pitchers show a great improvement, and are fast approaching to the body and style of the imported.

No. 281. The Moulded Tumblers are worthy of consideration as being a new and superior article, possessing the appearance of cut, with a brilliancy of polish that gives it a very high character among the dealers in that article.

No. 337. The set of Fluted Decanters is considered by the Judges as being the very best articles of Cut Glass exhibited, both for quality of the metal, and beauty of the cutting. They recommend it to the attention of the Committee.

No. 611. The Committee, so far as their knowledge of the Crown Glass and Window Sash extends, consider it a superior article, and deem it worthy of consideration.

No. 663. This lot consists of various articles; the attention of the Committee was drawn to the magnificent appearance of two large Bowls: they are certainly very beautiful specimens of the perfection to which the art of cutting glass has been brought in this country.

Nos. 122 and 610. Very neat variety of cut and moulded Knobs.

There is exhibited several very neat samples of Britannia Castors, from several manufactories, said to be hardened with German silver. The appearance of these is almost equal to the finest plate. No distinction can be made as to quality.

Report on Marble Work.

The report of the Committee on Sculptures, Marble Work, &c., not being submitted in consequence of the absence of Mr. Peale from the city at this time, the following abstract may be received as a substitute for it.

Of the Marble Mantels, though all were meritorious, and some of those from Messrs. Findley Highlands, Vanderbilt & Wildes, T. W. Burchell, Henry C. Webb, and J. Struthers, were especially remarkable for the goodness of the workmanship, the Committee did not feel itself called on to recommend any one for the premium proposed. They were in fact specimens of the beautiful mantels usually made by those gentlemen, and for

sale at their establishments; not more excellent, either in design or execution, than the Committee have often found there. Of the tables and marble work generally, the same remark may be made. Two exceptions, however, require particular mention. The first, a Dial Stand of highly wrought Italian marble, on a plinth of Breccia from William Struthers, which, in their opinion, deserves the highest praise for its symmetry of form, purity of decoration, and exquisite finish:—to this, had the Committee had power, they would have unanimously awarded a premium. The other exception which they would record, is the tablet intended for the Monument of Joseph S. Lewis, Esq., a landscape carved in bas relief, including architecture, rocks, foliage, and water: this, though not absolutely finished at the time of the Exhibition, presented evident marks of the graceful chisel of Mr. John Hill, and proved that the same skill which directed the admirable sculpture of the Washington Cenotaph a few years ago, could be equally successful in its application to an entirely different class of subjects.

The Scagliola Columns, Pedestals, and Tablets, submitted by Mr. John Skirving, as they were among the most marked and beautiful of the productions exhibited, also obtained the careful attention of the Committee. They need not, in a brief report like this, attempt to give the history of this very ancient and long lost branch of artist-like manufacture. It is enough to say that Mr. Skirving has succeeded perfectly in introducing among us a substitute for marble, admirably adapted for interior decoration—and that he imitates the porphyry, the lapis lazula, the verd antique, and the several varieties of brown and yellow variegated marbles, so as to rival, if not, in some cases, to exceed, the beauty of the natural stone. A comparison of his work with some of the best specimens of European production, ancient and modern, would justify for him a claim of entire equality of skill with the celebrated manufacturers of other countries, and the low prices at which he furnishes this beautiful material in a finished state, must in a very short time introduce it to general use among us. The Committee strongly recommend the award to him of an extra medal.

On the whole, the Committee would remark, that in the department to which their attention was called, though with the few exceptions which they have noted, there was nothing to require specification; yet there were marks every where of progressive improvement in the style and character of the arts, and of a rapid advance towards perfection of manufacture.

Report on Books and Stationary.

Presuming that the various Bibles (they being the only printed books on the list) submitted were not intended as specimens of printing and paper, (for no particular point of merit was observed) attention has therefore been given to their exterior appearance as Books.

No. 382. An elegant Quarto Bible of exquisite beauty, the side inlaid with rich panel work. A superb 8vo. Bible, in red morocco, with panel work, richly gilt, and lined with satin. These two volumes are the most beautiful submitted, and warrant high commendation for taste in design, and skill in execution. The remaining volumes are well and handsomely executed, and the whole evince a great degree of improvement. The printing of the Oxford Bibles is well executed, and the paper of a good quality. The set of super royal Blank Books, richly bound in Russia, inlaid with vellum, and fancy ruled, are noticed as the most beautiful and carefully finished fancy Blank Books that the Committee have ever seen; the ex-

treme neatness of the ruling in 7 different colours, requires a degree of skill and care that has not been surpassed. The Medium Books, with patent locks, are neatly and tastefully bound, with ruling of extreme delicacy; they are worthy of notice for the fixture of a lock on the front, which is a security for the cautious, who are willing to submit to the inconvenience of its position. The set of plain bound books presents no particular point of admiration, but are neatly bound and ruled.

No. 382. The various article of Stationary are well made, and highly useful for the purposes intended, being of kinds now in general use, and sold by the various Stationers. They display an increased improvement in such articles, that relieve us from the necessity of importing them. The articles made by Mr. Ruthven are worthy of particular notice as being neat and well made.

The various specimens of Paper are of the kind and quality of fine papers now in general use, displaying an increased improvement in make and finish. They would particularly notice the Note Paper, No. 85, and other papers made by Jessup, being of superior quality.

No. 454. Port Folio, (in case No. 382) an article of rich and gorgeous beauty of mosaic work, a most attractive fancy article, executed in good taste.

No. 123. Lead Pencils of Jackson's well known make, and generally admitted as the best made in the country.

No. 414. Lot of Quills, well prepared, neatly put up, and good of the various qualities.

No. 652. File Presses, a useful article, well made, and neatly arranged.

No. 172. Two Books for the Blind, executed from type prepared by Robb & Ecklin, printed by Mr. Snider, at the "Pennsylvania Institution for the Blind," the one the Book of Proverbs, the other the Student's Magazine, a periodical published at the Institution, and containing original compositions for the pupils—well and neatly executed in every respect, and excites our admiration for the mental enjoyment thus prepared for an afflicted portion of our race.

No. 501. Two large Maps, of acknowledged geographical correctness, and of neat execution in the mechanical departments.

No. 614. Two Plans of the City and Districts, on an extended scale; in the printing, colouring, engraving, and mounting, neatly and handsomely executed; the whole presenting a pictorial effect.

Several other books attracted the attention of the Committee, which are not found on the list: among these may be mentioned a beautiful specimen of Law Books, "The Civil Code of Louisiana," executed, in all its parts, by Philadelphia workmen—the stereotyping by L. Johnson, printing by Collins, binding by R. P. Desilver, paper from Magarge's,—executed through the agency of S. M. Stewart, for Johns & Co., New Orleans—the handsomest law book within our recollection. Also, "The Gift," an Annual published by E. L. Carey & A. Hart, and executed solely by American workmen; beautiful, whether viewed in its engraving, printing, paper, or binding, and superior as a volume; displayed an increase in the improvement of such fine work.

Report on the Fine Arts.

Though limited in the number of its contributors, this department furnishes several proofs of superior merit: among these the Committee would particularize the fine portrait of Chief Justice Marshall, by Peale; Charity,

by Monachesi, (copy from a small original;) the Portraits and Fancy Pieces by Parker; Marine Views, by Birch; Domestic Animals, by M'Murtrie, pupil of the Academy of Design; Architectural Designs, by Haviland; Landscapes, by Miss R. Sully; Mezzotinto Engravings, by Sartain; Fancy Paintings, by Gibson, &c. &c.

Report on Fancy Articles.

The Committee on Fancy Articles beg leave to report, that they have examined each of the articles enumerated in the accompanying list, which they now return, with the following series of observations.

No. 157. The Pleasure Boat "Thought." Much praise is due to the builder of this truly beautiful and accurate piece of workmanship. Its extreme buoyancy, (for it weighs only 59 pounds, and draws, with one man seated in it, no more than two inches and a half of water,) combined with its strength, the excellence of its mould for cleaving the water, and the tastefulness of its finish, make it deservedly an object of commendation.

No. 216. Model of James' Life Boat—

This model of a very successfully planned Life Boat was removed by the depositor for the purpose of taking out a patent, and the Committee are unable therefore to make any further allusion to it.

No. 261. Specimen of Coach Painting—

This ornamental coach panel exhibits very considerable taste and skill in the design, and the delicate yet accurate manner in which the colours are laid on.

Nos. 266—268. Two lots of Gum Elastic Goods—

These articles which are manufactured at Roxbury, near Boston, recommend themselves strongly to favourable notice. They consist of gum elastic attenuated into thin sheets, and these sheets, in some specimens, cemented apparently by simple pressure to the printed surface of calicos, chintzes, engravings, maps, &c., and in others made themselves the ground upon which various coloured patterns are imprinted. The peculiar merit of these goods is in their retaining, in a perfect degree, all the original qualities of the gum elastic; its elasticity, its toughness, freedom from odour, and absence of all adhesiveness: the latter feature giving to this manufacture a decided superiority over any other preparation of the gum hitherto attempted. The attention of your Committee was particularly attracted to the beauty and evenness of texture of a shawl, consisting wholly of the gum elastic, upon which a very tasteful pattern had been impressed.

No. 310. Two cases of Flower Stands—

In neatness of form and execution, these articles, which are not merely ornamental, but very commodious, either in the greenhouse or elsewhere, are well worthy of commendation.

No. 336. A Lady's Work Box, with transferred ornaments—

Among the smaller pieces of fancy furniture, we noticed with pleasure the good taste and skill which had embellished a very neatly constructed lady's work box, with the transfer of some well-selected engravings.

No. 346. Twenty-four Articles from the Institution for the Blind—

For accuracy and fidelity of workmanship, these articles would do credit to citizens blessed with the assistance of sight. Neatness and excellence in the workmanship, distinguished them all. The specimens of twine and rope amply justify these remarks.

No. 389. Several Vases, some of Shell Work, some of Alabaster, containing Artificial Flowers in Wax—

Nothing in the entire catalogue of fancy articles, appeared to receive from the public a larger tribute of praise, or one better merited, than these admirably executed flowers in wax. For their close adherence to nature, their correctness of form, even in minutiæ, the exquisite beauty, delicacy, and truth of their colours, and the pure taste displayed in the arrangement of each superb bouquet, they will vie with the very finest specimens which this most tasteful art can furnish.

No. 405. Two pieces Fancy Work—

These struck us as possessing a very considerable degree of excellence, and as showing a good taste in the selection of the colours and in the workmanship.

No. 414. Twenty specimens in imitation of various Ornamental Woods.

Some of these specimens were in the form of centre tables, representing many different kinds of wood inlaid; others were imitations of portions of polished veneers, the painting being done on sheets of tin.

It is difficult to conceive any material advance in this branch of painting, beyond the point attained in these beautiful imitations of polished woods. In representing both the colours and the *grain* peculiar to each species of wood, the artist has been eminently successful, indicating a close attention to nature. We were much gratified at the beautiful and very faithful representation of a veneer of black walnut. So well painted was one of the centre tables in particular, that few of the many who gazed admiringly at it were aware that it was not a superior specimen of inlaid work.

The imitations of ornamental marbles, though in some instances well done, were on the whole much less happy efforts of the brush than those of wood here alluded to.

Two French panels, and an imitation of damask paper, for wall painting, were all very creditable specimens of good taste and skill.

446. A Silver Speaking Trumpet—

This specimen of the silversmith's art exhibited all the requisites of exact and delicate workmanship, with a just taste in the form and the embellishments of the instrument.

487. A lot of Anthracite Ware—

We would call attention to the neatness and good finish which characterized the specimens of anthracite ware. The usefulness of these articles, and their appropriate shapes and fine dark polish, place them high as ornamental pieces of furniture.

No. 565. Needle Work Stools—

These highly beautiful pieces of furniture represent, the one a dog, the other a deer, in raised needle work upon a ground of drab cloth, and both are remarkable for the rich effect of the workmanship, which gives token of the skill, taste, and patience of the artist.

587. Composition Vase—

This, which is a large vase of some species of stucco, painted, and sprinkled with fine sand, to imitate a light gray sandstone, is of truly classic model, and as an article of ornament for a hall, is well deserving of approbation.

592. A Cane consisting of many Joints of several kinds of Wood, screwed together—

Considerable praise is due to the neat and ingenious artificer of this very pretty cane. The accurate workmanship in it is much to his credit, but the feature especially deserving of encomium is the soft and exquisite polish imparted to the surface, not by varnish, but by rubbing in some fluid by the

aid of simple friction. This mode of bestowing a polish on wood is much in vogue in France, where it is made to supersede the use of varnishes, almost entirely, in some descriptions of furniture. By displaying the natural fibre of the wood in all its beauty, and clothing the surface with a soft and mellow polish, wholly devoid of glare, it recommends itself to favour, beyond any other mode of embellishing and preserving ornamental wood work.

No. 715. Flowers, worked in worsted, by Miss Sally Ann Fling—

The selection of the colours, and the softness and grace in the delineation of these flowers in needle work, evince a cultivated talent in the fair artist by whose hands these beautiful bouquets were wrought.

In another apartment, we gazed with much satisfaction upon an elaborate picture, in needle work, of Fairmount and its environs, by Miss Parkinson. There is really much to commend in this piece, in the elegance and neatness of the handywork, while its accuracy as a likeness of a well known and cherished scene, makes it a most pleasing performance.

No. 814. Worsted Needle Work, by Mary Pastorius—

We are disposed to rank this specimen of needle work, and also another, No. 820, by Louisa Miller, as among the best executed pieces of the kind in the whole exhibition.

No. 786. Landreth's Garden—a Perspective Model—by a Lady of Philadelphia, deposited by W. L. Pitfield—

A more pleasing specimen of this kind of workmanship we have rarely seen. Its fidelity in the smallest details of form, colour, and perspective—the greatest merit in this species of model—is truly remarkable, and the whole betokens a true taste, and gives evidence of no small amount of skill.

Report of the Committee of Arrangement.

To the Committee on Premiums and Exhibitions of the Franklin Institute.

The Committee of Arrangement for the Tenth Exhibition respectfully Report:—

That, in execution of the arduous duties undertaken by them, they have endeavoured, from their first organization until the successful close of the Exhibition, to discharge acceptably the task assigned them. The readiness and unanimity with which this task has been fulfilled by the various sub-committees, and the general good feeling which has prevailed among the visitors and contributors of the Exhibition, during its whole course, are sources of great satisfaction, and particularly to those who have been most emulous to gratify public expectation. Some reasonable fears were started that we should not, with so short a notice as we had, be able to accomplish all that was expected; but these fears were converted into assurances the most flattering, that the public, as well as the members of the Institute, have been equally disappointed in the extent, variety and arrangement of the Exhibition; and we may, therefore, now give up our posts without self-regret, hoping that others may fill our places hereafter with more confidence in themselves, and satisfaction to others. Before parting with each other, however, and with the view of offering the result of our experience to those who are the more immediate guardians of an institution than which none in this country is more devoted to the best interests of the community, where progressive improvement in the arts is the main-spring of our national prosperity, we take leave to suggest the four following hints.

In the event of another exhibition, which we think should not be sooner than 1840, a strong appeal should be made to our citizens to provide a more commodious building, and one better lighted and ventilated, than the Masonic Hall. An earlier notice, and more ample time for procuring and arranging the specimens for the Exhibition, would be desirable; and, as no period of European history can furnish a parallel to the intense activity, laborious enterprise, and productive ingenuity which now distinguish the American people, it will be proper to make arrangements for exhibiting the vast improvements in the arts and manufactures resulting therefrom, on a scale commensurate with their importance. Spacious as the Masonic Hall is, there was not space enough in all its rooms to arrange properly all the specimens already presented, and when the intended School of Arts is established, we may expect a much larger display.

In connexion with this School, which we doubt not will soon be sustained by the wisdom and liberality of our Legislature, it will be a benefit to the country, but more especially to our own state and this city, if the Franklin Institute may possess every means of maintaining the primary stand it now holds among the promoters of public improvement; but without the aid of commodious halls for lectures and exhibitions, so situated that the public may patronize them, other cities will soon have that precedence which is now due to our own. We hope, therefore, that prompt and vigorous measures will be taken by the Managers of the Institute to have another and more suitable building erected on the site of the Masonic Hall, so that we may not be constrained to present an iron face towards our patrons, nor devote the profits of the Exhibition to temporary expenditures.

The general arrangement in regard to Exhibitions, we think susceptible of some improvement, and, with proper deference, we would now suggest that a primary committee should be formed early to consist of the Committee on Premiums and Exhibitions and the several Chairmen of the various Sub-Committees of Arrangement, and that one of the Committee on Premiums and Exhibitions should always be in attendance during the Exhibition, and, if necessary, act as umpire. By thus acting in rotation, there would be some one to decide always on any subject requiring a decision among the committees or depositors.

The continuance of the Exhibition we think should not be less than a fortnight, and distant contributors should have ample notice of every facility given them to forward their goods or machines, and premiums be awarded to the most deserving, notwithstanding they may have received them from other societies.

All which is respectfully offered.

For the Committee of Arrangements.

C. C. Haven, Chairman.

Philadelphia, Nov. 23, 1838.

Physical Science.

The following communication was received too late to be inserted in its proper place, but as the writer was desirous to have it published in the same volume with the article to which it is a reply, the Committee have judged it better to place it thus out of order, than to postpone it to the next volume.

Com. Pub.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Remarks on Mr. Espy's Theory of Centripetal Storms, including a Refutation of his Positions relative to the Storm of September 3rd, 1821: with some Notice of the Fallacies which appear in his Examinations of other Storms. By W. C. Redfield.

The practical importance of the investigations which relate to the character and courses of our great storms, will be deemed sufficient apology for this communication.

Early in the year 1831, an article on storms appeared in the American Journal of Science,* the main objects of which were, to point out the relative or whirling character of the great storms which visit the Atlantic coast, their origin in the intertropical latitudes; the circuitous or semi-elliptical character of their several paths or orbits; the general uniformity of their courses through the tropical and temperate latitudes; and the obvious cause for the continued depression of the barometer which is found in the centrifugal influence of their rotary action.

In drawing up this paper, I deemed it not inappropriate to exhibit the origin of the views or conclusions therein maintained; they having been first suggested by extensive personal observations of the phenomena of the storm of September 3d, 1821, in the states of Connecticut and Massachusetts, and confirmed by numerous personal inquiries, made at that period, of ship masters and other intelligent persons who had observed its action. I also added, in a very condensed form, such marine reports relating to this storm as appeared to afford further information. My statements, as then published, were copied extensively into the newspapers of the day, and had a wide circulation among the intelligent inhabitants of New England, who had witnessed the effects of this storm; and, so far as I know, their general accuracy has never been called in question.

Having shown the origin of my investigations, I proceeded to a more particular statement of the phenomena which were exhibited at various localities by the north-east storm which visited New York on the 17th of August, 1830; showing from an extensive collation of facts, its whirlwind character; its identity with the hurricane which visited certain islands in the West Indies five days before; its course, daily progress, and uniform character during this period; its further progress to the Banks of Newfoundland; and also its absolute identity with the E.N.E. S.E., S., S.W., and northwesterly gale which prevailed off this coast on the 17th, at or near the time when the gale was blowing at N.E. at New York and its vicinity. These results, which, for the most part, appear not to have been previously sus-

* Silliman's Journal for April, 1831, vol. xx., p. 17—51.

pected, have been more fully generalized and illustrated in subsequent papers: and are also exhibited, in a most convincing manner, in the highly valuable work of Col. Reid on the Law of Storms, which has lately been published at London.

It appears, that since the results of the above inquiries have been brought before the public, Mr. Espy, of Philadelphia, in considering the laws of aqueous condensation, has been induced to believe that he has discovered the true cause of winds and all the various phenomena of storms which occur in our atmosphere.* This theory, which he has set forth in a series of essays in this journal, appears to have formed the basis of his reports as chairman of a joint meteorological committee of the American Philosophical Society and the Franklin Institute.

The type of this new theory, or of the manner in which it is supposed to be exemplified, it is believed may be found in the movements of the air in a common chimney, or bonfire: but it appears to find little or no support in the facts which have been brought to notice during my inquiries into the phenomena of the Atlantic storms. Encouraged, however, by plausible, but erroneous inductions, made from the phenomena of the New Brunswick tornado in June 1835,† and by friendly, though perhaps injudicious support and announcements from highly respectable sources; and aided also (with few exceptions) by the favour and guardianship of the Philadelphia press, Mr. Espy has continued to labour with assiduity for the establishment of his theory.

In a brief introduction to his essays in April, 1836, Mr. Espy announced that "he had collected such a mass of facts as would place his newly discovered theory on an immovable foundation;" and that his readers would find developed in his essays "a law" which explains at once "all the *seven* phenomena of rain, hail, and snow, water-spouts, land-spouts, winds, and barometric fluctuations.‡"

Of the manner in which this modest announcement has been sustained, and of the apparent errors or misapprehensions of facts and of the principles of science, which abound in these essays and subsequent papers, I forbear at this time to make inquiry. But in one of these essays, (August, 1836, p. 105—108,) he gives a constructive abstract of my account of the storm of 1821, which abstract is then claimed to be inconsistent with a horizontal whirlwind, and he adduces these constructive phenomena, as "proving with irresistible evidence the existence of an upward vortex in this storm;" meaning here, by a vortex, not a gyrative movement, but a chimney-like motion.§ He also treats as an unwarranted conclusion, the observed fact, that "*along the central portion of the track, the storm was violent from the south-eastern quarter, changing suddenly to an opposite direction.* Disregarding, also, an important portion of the evidence, he then proceeds to assert, without, however, offering any proof, "that it was on the S.E. side of the storm at which the wind set in S. of E.," and further, that he could not find that the wind had changed from the S.E. to the N.W. quarter, as I had represented.

To this effort to set aside the results of my observations and inquiries, I

* Jour. Frank. Inst. vol. xvii., p. 240 vol. xxiii., p. 153, &c.

† Some incidental remarks on this tornado will be published in the June number of this Journal.

‡ Journal Frank. Inst., April, 1836, vol. xvii., p. 240.

§ Ibid, August, 1836, vol. xviii., p. 105.

replied in a communication which appeared in this Journal for February, 1837; (vol. xix., p. 112—127,) to which the reader is now referred.

It must appear obvious, however, to Mr. Espy, that the action of the Atlantic storms, as developed by my own inquiries and those of Col. Reid, cannot be reconciled with his supposed centripetal movement of the winds, *even for hundreds of miles*, in nearly right lines from all sides towards the centre of the storm:* and hence the renewed attempt which we now find in the March number of this Journal, to invalidate the facts which I had adduced, and to obscure or pervert their plain and obvious bearing.

In the freedom and candour of these prefatory remarks, it is by no means intended to impeach the sincerity or integrity of Mr. Espy, in any of his strictures or positions: but the strong bias which has apparently resulted from having preoccupied his mind with the speculations which he connects with his favourite theory, causes him to "suspect" every fact or conclusion which militates with his cherished conceptions, and to press into his service nearly all the heterogeneous phenomena in nature. This seems to disqualify him, at least in a measure, for instituting a rigid and impartial system of inquiry, suited to the present state of knowledge, and to the obvious demands of his assumed position, as a reformer in meteorological science. It appears to have been the misfortune of Mr. E. to have commenced his labours at the very point where, if successful, they should have terminated; viz. in establishing a general theory of atmospheric physics, resting on the basis of observation and strict induction in every class of natural phenomena which are sought to be comprised in his system. The attempt to explain nearly all the physical phenomena of the atmosphere by the theory of aqueous condensation, is not unlike that of him, who, in essaying to climb, should commence at the last and highest step in the ladder. In so diffuse and complex a science as meteorology, it is not by this inverted Baconian process that we can expect to "ascend from effects to their causes."

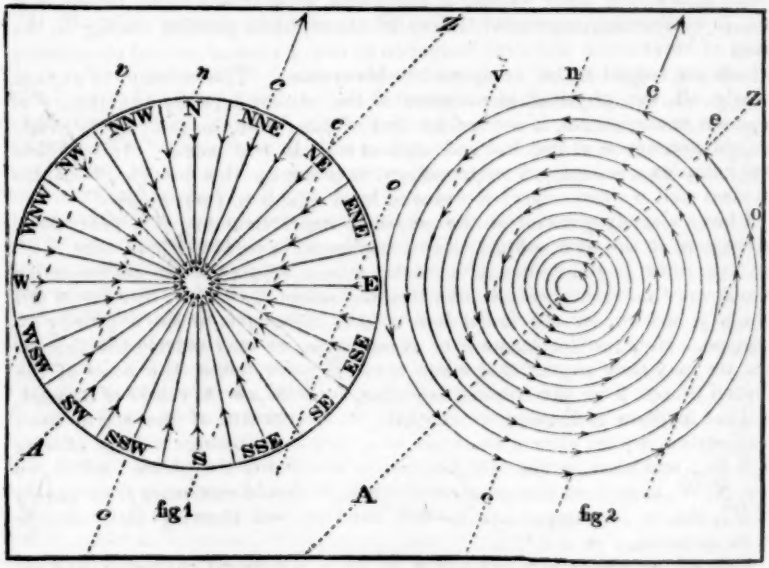
I have already glanced at the physical impracticability of a centripetal movement in the atmosphere, over a surface of several hundred miles in diameter, towards the centre of a storm; where, instead of the accumulation which must inevitably result from this movement in the air, its state of diffusion is known, by the indications of the barometer, to be unusually increased. But, for the purpose of examination, we may assume the theory; and we may then expect that when a storm moves along the coast of the United States, from the tropical latitudes, the wind, *on the centre of its path*, will set in from N.E., and so continue till the centre of the storm itself shall arrive, when, after a short lull, or a very rapid change, it must change to S.W., and blow in this last direction to the end of the storm; while, on the N.W. border of the centripetal storm, it should *commence from nearly N.W.*, and be of comparatively short duration, and showing little change in its direction.

But, on the contrary, if the storm be of a whirlwind character, and revolving to the left around its own central lull, or axis, then, if regularly exhibited, the N.E. wind at its commencement must pertain to the left hand

* It should here be kept in mind, that half of the entire atmosphere lies below the height of three and a half miles. I have also good reasons for believing that the entire masses of our storms lie beneath this comparatively small elevation. What space for the exhibition of a vast centripetal column, whose semi-diameter is even imagined to have extended, in one case, from Iceland to Italy! See Journ. Frank. Inst. Oct. 1836, vol. xviii., p. 241, 242.

portion of the storm, (N.W. of its centre) and, as the storm advances, will change by the N. to the N. W. quarter. While *on the centre of its path*, the wind must set in from near to S.E., *blowing across the track of the storm*, and when the axis, or lull, has passed, the wind will be found in the N.W. quarter, blowing across the track of the storm, in the direction opposite from the commencement: and in places near to which the lull of the storm may pass, the wind will veer round, more or less suddenly, in proportion to the distance, towards the direction which is opposite from its commencement.

For the illustration of these positions, I refer to the annexed figures, the first of which illustrates Mr. Espy's centripetal theory, as applied to the storm of 1821; which, in the latitude of Philadelphia, was moving nearly N.N.E., as indicated by the line and arrow head *c, c*. Fig. 2 illustrates the rotary or whirlwind theory as applied to the same storm; which, in its advance, would be intersected by the several geographical stations, *v, n, c, e, o*, on the several lines of arrow heads which are found in line with these stations on both figures. The direction of the several arrow heads represents the direction, as well as the order of changes, which the wind would present to an observer, at each of these stations, according to the two theories.



A supposed variation of the course of the storm, and of the lines of intersection on the two figures, to N.E., parallel with the lines A, Z, may serve to illustrate the application of the two theories to storms that move in a N. E. direction, which is their more general course in these latitudes.

The foregoing remarks and illustrations are deemed necessary for a right understanding of the subject before us.

The positions of Mr. Espy which I propose at this time to refute, are found in his Examination of Col. Reid's Law of Storms; in a portion thereof

which he states to have been written in his official capacity as meteorologist of the joint committee at Philadelphia, but not accepted by the committee. He here proposes to "demonstrate" that the storm of Sept. 3d, 1821,* was not "exhibited in the form of a whirlwind, but was like the twelve storms which have been investigated [?] by the joint committee of the American Philosophical Society and the Franklin Institute, that is, that the wind blew inwards at its borders." He says, "this conclusion is rendered certain by the following facts, [allegations?] which are deductions from the particulars given below."—We shall see.

First position. "The storm set in every where on the extreme S.E. border from the S.E., and not from the S.W., and changed round to the S.S.W. or S. And on the extreme N.W. border it set in from N.N.E., and blew hardest from the N. and N.W. Now, on the extreme S.E. border, it could not blow from the S.E. at all, on the supposition it was a whirlwind; nor, on the N.W. side, could it blow at all from the N.W. Both facts, however, are not only consistent with a centripetal motion of the air, but absolutely prove it." p. 149, March number of this Journal.

That by the "extreme S.E. border," is here meant the extreme outward limit of the storm in that direction, is evident; for, assuming, as he appears to do, that the course of the storm was N.E., it is only upon "the extreme border," according to his own theory, that the storm could set in at S.E.; and because the position would otherwise be destitute of any discriminating value.

We begin with the two positive allegations: 1st, "The storm set in every where on the extreme S.E. border from the S.E.:" and 2d, "On the extreme N.W. border it set in from N.N.E." From the evidence recited as supporting the alleged facts, we find a wide portion of the central track of the storm on which it is reported as beginning at S.E., viz: from the coast of Maryland, and New Jersey, and thence on a line through Bridgeport and Middletown, Conn., on one side, to an unknown point off Cape Hatteras, and a line drawn from thence, at a distance from the coast not well ascertained, but passing perhaps through the towns of Providence and Boston on the other.† Now, what evidence has Mr. Espy adduced, that the easternmost general limit here alluded to, was "the extreme S.E. border of the storm?" On this supposed limit, we find the storm raging with violence, and this wind could not here have sprung instantaneously into action, but must have swept from a greater distance, though doubtless with a diminishing force and modified direction, as it became more remote from the axis of the storm.

But we are not left to this obvious conclusion: for we find in the evidence adduced, that "a vessel from Bermuda experienced the gale from the westward on the inner edge of the Gulf Stream." Probably from the S.W. quarter, i. e. *westward of the meridian*, a colloquialism common with nautical men; and on any construction, this statement alone refutes the position.

We find, 2d, "in lat. 38° 30′, on the inner edge of the Gulf Stream, *gale from the westward.*" This also agrees with the foregoing, and disproves the position.

* Journ. Frank. Inst., March, 1839, vol xxiii., p. 149—158.

† It is my own opinion, that the S.E. wind was not found eastward of a line passing through New London and Worcester, but newspaper reports have given the direction at S.E. in general terms, to the extent here mentioned, where I suppose the storm was S.S.E. nearly, or at best S.E. by S., in the early part of the gale.

3. We have also reported in lat. 38° 30′, lon. 74° 30′, gale S. by E. Whether this longitude be printed correctly or otherwise, this report contradicts the position. It is true also that we find "a ship from Boston to Norfolk [Bristol Trader, three days out,] in lat. 40° 19′; weather foggy, and light winds from S.E.;" but she had met with head winds, and judging from the position of Nantucket shoals, it appears not probable that she was westward of their meridian, and she may have been much further to the eastward:* and to assume a direct connexion and identity of these exterior "light winds from S.E.," with the S.E. gale in Connecticut, is assuming the very point which is necessary to be proved; and such a conclusion, it will be seen, is contravened by other facts.

I now submit further evidence, to show that the border here claimed was not the extreme border, and also, that as we proceed from the centre of the path of the gale towards its eastern border, it was found to commence from a point southward of S.E., which could not happen according to Mr. Espy's theory, as may be seen by referring to fig. 1.

4. We have accounts of the gale eastward of the Bay of Rhode Island, and in Bristol harbour a vessel was driven on shore: probably not by a S. E. wind.

5. The ship Camillus, Peck, from Greenock, which arrived at New York on the 7th September, *experienced the first part of the gale from S.S.E.*

6. Schooner Juno, Low, from Aux Cayes, reported at Salem, September 5. On Monday morning, Sept. 3d, saw a dismasted vessel, eight leagues E. of Cape Cod. *Had a heavy blow on Monday night, at S.S.E.*, and a very high sea running.

We thus see, in part from Mr. Espy's own evidence, that his "extreme S.E. border" of the storm is a mistaken assumption, and that his extreme S. E. wind (which, upon his theory, should have been E.S.E., as the course of the storm in this latitude was nearly N.N.E.,) has been already traced round to S.S.E., and, could the inquiry be carried out, I have no doubt we might follow it round to the westward of the meridian, as experienced by the vessel from Bermuda.

We proceed now to the supposed "extreme N.W. border," where it is alleged that the storm "set in from N.N.E." I might, however, rest contented with this allegation; for the admission that the storm here set in from N.N.E., i.e. in the direction which is contrary to the progress of the storm, is in strict accordance with the whirlwind theory, and fatal to his own, which would here require the wind at W.N.W., or nearly; while his N.N.E. wind should be confined *to the centre of the track*, and yet Mr. Espy here makes the unfortunate assertion, that such facts as this are not only consistent with a centripetal motion of the air, but absolutely prove it!

The only places I find mentioned where the gale is said to have set in at N.N.E., is in one of the reports from Norfolk, and another from Bombay Hook, near the head of Delaware Bay, from both which places the other accounts say N.E.; but in one of these points of direction, (N.E.) Mr. E. has fixed the centre of the storm, and the gale was heavy on this line of track: how, then, does he find here "the extreme N.W. border?" But more of this as we proceed.

* This last supposition appears not only probable, but almost certain, from this fact, that the ship Camillus, from Greenock for New York, was up with Nantucket about three days before the gale, but was unable to get to the westward if not driven back; so that she took this gale at S.S.E., and did not then arrive till the 7th.

Second position. "Wherever the wind set in from the E., it always changed round by the S., which is consistent with the centripetal, and inconsistent with the centrifugal, theory." p. 149.

The entire want of arrangement in the facts collected by Mr. Espy, somewhat impedes the inquiry; but on examination, I find mention of only three places where the gale is said to have set in at E., viz. off Roanoke; in some of the accounts from New York; and in a letter from on board steamboat Connecticut, which went that day from New York to New Haven. Of these, the report from Roanoke represents the wind not as changing "round by the S." but first at E., and then S.W. At New York also, no mention is made of a change from the E. round by S. The "wherever" would appear, therefore, to be found only at, or near, New Haven. Here, it is true, the wind "changed round," not from E., but from S.E., "by the S.," *as it should do*, (except on the line of lull,) *according to both theories*, (see figures.) Intelligent friends, (one a ship master,) then on board the Connecticut, assured me that the gale here set in nearly from S.E., and hauled somewhat suddenly to the S. and S W., (owing, as I suppose, to the near proximity of the lull at that time,) and by this change the Connecticut was driven from her anchors and cast on shore at Morris' Cove, East Haven. It was within my own observation, also, that trees prostrated by the first part of the gale in New Haven and its vicinity, pointed, not to the W., but N.W., or more northerly, showing a S.E. or S.S.E. wind, and numbers of these indubitable records remained in this position for years, some nearly to this day. The observations made at New Haven, for the Connecticut Academy of Arts and Sciences, (and furnished to Mr. Espy by Mr. Rich, now a member of Yale College,) also fix the wind at S E. Nor does it appear, on any theory, how the wind could have been more eastward at New Haven, than at Bridgeport and Middletown, where the printed reports state it to have been S.E. The position, therefore, fails.

Third position. "There never was a lull mentioned, only where the wind set in from the N.E., which has the same bearing as before, for the centre of the storm only can have a lull." p. 149.

Let us try this allegation by the evidence then before Mr. Espy.

1st. In the marine reports, from localities where the gale set in from S.E. to E., we may rightly infer the presence of the lull from the phenomena which are expressly mentioned. As, off Roanoke, "a dreadful gale at E.,* *then S.W.*," (p. 153) for we know that the gale seldom shifts to nearly the opposite quarter, without an intervening lull. Again, at sea, 40 miles N. of Cape Henry, severe gale from S.E., *changing to N.W.*" The last remark applies still more strongly to this report. To which I may add as positive evidence, (not, however, then before Mr. Espy) that a shipmaster, whose vessel was driven on shore to the southward of Cape Henlopen, with the wind "right on shore," also described to me the sudden lull, and the ensuing blast from W.N.W. Also, the schooner Mark Time, from Norfolk, (New York Gazette, September 7,) experienced the gale from S E. off Chincoteague, Md., *was thrown upon her beam ends*, and remained an hour in that position, when *the shift of wind to the westward righted her.* This vessel would hardly have lived so long in this position, except she had fallen into

* It should be noted, that an E. wind in this part of the track, where the course of the storm was nearly N., corresponds, in the character of its changes, to an E.S.E. wind in the latitude of Philadelphia, where the course of the storm, or the curve of its track had changed to nearly N.N.E.

the lull, and being righted by the sudden shifting of the wind, might fairly imply, that after the lull, it had suddenly come out from the opposite quarter.

2d. "At Cape Henlopen, Delaware, the hurricane commenced at half past 11 A. M., *from E.S.E.*; shifted in 20 minutes to E.N.E., and blew for nearly an hour. *A calm of half an hour succeeded*, and the wind then shifted to W.N.W., and blew, if possible, with still greater violence," p. 154. Here, certainly, is mention of a lull, and no mention of a N.E. wind.

3d. The National Gazette, adduced by Mr. Espy, states: "At Cape May, from 1 P. M. till half past four, the wind blew a violent hurricane from S.E.," p. 158; and my own reports (p. 154) state that the gale here "commenced at N.E. at 2 P. M., and veered to S.E., and blew with great violence,—*after abating* 15 *minutes*, it again blew with increased violence for two hours, and then abated." The direction of the wind, after the lull, is not stated, but being the close of the storm, it was doubtless from the westward, as at Cape Henlopen, which is distant but 13 miles, and nearly in the line of the storm. Here is the only pretence which I can find for connecting the lull with a N.E. wind, which the collation of accounts shows to be an error, or at best only an incipient wind at Cape May, and not the true easterly wind of the gale. But further:

4th. "This storm, as experienced in the central parts of Connecticut, commenced blowing violently from E.S.E. and S.E. about six o'clock in the evening of the 3d day of September, having been preceded by a fresh wind from the southern quarter, [from S. or S.S.E.,] and flying clouds. It continued blowing in heavy gusts with increasing fury, till about 10 o'clock, P. M., when the wind suddenly subsided. A calm, or *lull*, of perhaps fifteen minutes duration ensued, which was terminated by a violent gust from the N.W., which continued till about 11 P. M., and then [i. e. from that time,] gradually abated." (Silliman's Journal, April, 1831, vol. xx., p. 20.) This (which lay before Mr. Espy) was the testimony of an actual observer, who resided on the ground, was familiar with the points of the compass as connected with the winds, from his boyhood, and had the best possible reasons for knowing the direction and strength of this gale; who had then formed no theories on the subject; who for months, and even years, afterwards, had also before him nature's own records of the direction of the wind, as exhibited in the prostration of the orchards and forest trees; and who is perhaps the only person living who made extensive and careful observations and inquiries on these points at the period of the storm.

Of the surprising character of this allegation, "that there never was a lull mentioned, only where the wind set in from the N.E.," it does not become me to speak; but I infer that Mr. Espy has here drawn mainly upon the centripetal image existing in his own mind, rather than upon the recorded observations which lay before him.

Having thus shown the error of this statement, and that the lull was on or near the line of S.E. wind, and as Mr. Espy also here admits that the centre of the storm only can have a lull, it appears to follow that 'this storm *was* exhibited in the form of a great whirlwind," as I had previously maintained; for the point here discussed, involves the main question between the two theories.

Fourth position. "Where the wind set in from the S.E., there is no lull mentioned previous to a change of wind, and in no instance could I find that it changed round to N.W. Two instances are given by Mr. Redfield, one at Bridgeport, Conn., which I find is incorrectly reported, [?] and instead

of changing round to N.W., it should read S.W.:—the other at sea, 40 miles N. of Cape Henry; this I could not find, and I suspect there is something wrong in it, for 40 miles N. of Cape Henry is not at sea, but in the eastern shore of Virginia. [!] At other places in a right line with this, it set in from the N.E., e. g. at Cape May and Norfolk." p. 149—150.

The first assertion here, that "where the wind set in from the S.E. there is no lull mentioned previous to a change of wind," is refuted by the facts just reviewed; this being a reiteration of the foregoing position in another form. But he here says: "*in no instance* could I find that it [the S.E. wind] changed round to N.W." The value of this extraordinary assertion has also been seen.

Unfortunately, it appears that two of my cases have been "*suspected*" by Mr. Espy as being contrary to his theory.* We have before heard of his finding of the error at Bridgeport, where, by his showing, "the wind commenced blowing hard from S.E. about 6 P. M., and continued to increase in violence *till about* 9 *P. M.*, [the italics are mine] when the tempest raged with a degree of fury the most awful and destructive. The storm continued with unabated force until near 11 P. M., when the wind hauled round to S.W., and gradually abated."

I see nothing in this account to support Mr. Espy, except the obvious omission to state the direction of the wind from 9 to 11: for we know that the centre, or axis, of the storm, which, from the indications of the barometer, we find to have been opposite to New York at 7h. 30m. P. M.,† must have passed Bridgeport at, or soon after, 9, about the time which my information fixes the change at New Haven, and was at Middletown and Hartford about 10; and immediately after this crisis of the gale, the wind is known to have been blowing from the N.W. quarter on all this line. Neither have we any reason to doubt the account from which my own statement was taken. After 11, i. e. two hours *after* the passage of the centre of the storm, "the wind hauled round [from N.W.?] to S.W., and gradually subsided." My own knowledge, and inquiries made at the time, corroborate this view of the facts.‡

The observations made "at *sea*, 40 miles N. of Cape Henry," it appears are set aside, because that 40 miles *due* N. of that Cape is on land, "in the eastern shore of Virginia"! This is quite unworthy of Mr. Espy and of his cause; for who did not perceive, that by this phrase was meant, 40 miles from Cape Henry, on the usual route of vessels bound northward. On this subject I find the following:—

Norfolk, Sept. 9th, 1821. Arrived, sloop Atalanta, Philips, of Swansey, bound to Charleston. August 26, off Cape Hatteras, close in with the land, experienced a severe gale from S.E., which split her sails to ribbons, and made it necessary to put into the first port. On the 3d instant, about 40 miles N. of Cape Henry, experienced another severe gale from S.E., which hauled round soon after to N.W., which made the A.'s situation so embarrassing, that it was with difficulty she could be got in.

* Journ. Frank. Inst., August, 1836, p. 105. I quote the italics.

† In the New York American, Sept. 4, I find the following facts communicated relating to the state of the barometer in this storm; at 6 A. M. 30.13—2 P. M., 30.05—6 P. M., 29.62—7 30 P. M., 29.38—8 P. M., 29.53—9 P. M.; 29.64—10 P. M., 29.07—the last, evidently a typographical, or a clerical, error.

‡ From the best estimates which I have been able to make of the course of the lull or centre of this storm, it would appear to have crossed Stratford Point and Milford, on the N. shore of L. I. Sound, passing between Bridgeport and New Haven, and perhaps nearly touching one, or both, of these places.

The worthy captain of the Atalanta, and his marine reporter at Norfolk, will doubtless be surprised on finding that the reported position of this vessel was "not at sea, but in the eastern shore of Virginia." The reader, however, will here perceive at least one other instance in which the S.E. wind *did* "change round to N.W."

It is strange enough that the "right line" of N.E. wind should have been located through Cape May, where, according to Mr. Espy's own showing, from the National Gazette of September 7th, "from 1 P. M. till half past 4, the wind blew a violent hurricane from S.E." p. 158. Instead of this, we find this line to have been through Edenton, Norfolk, Chesapeake Bay, Bombay Hook, and New Castle, Philadelphia, Trenton, and New Brunswick; at all which places, instead of a lull and opposite gale, the storm veered to N.W. I see nothing left, therefore, of this position.

Fifth position. "Along the seaboard, where the wind had been S. and S. E. all day, at the approach of the storm, it backed round towards the E. and E.N.E.; and inland, where the wind had been N.W., it backed round towards the N. and N.E., on the approach of the storm." p. 150.

I cannot perceive any relation which the direction of the wind, *previous* to the arrival of the storm, can have upon the question at issue. Nor do I perceive that this vast generalization of the previous winds, westward of the main line of the storm, is supported by any evidence, except by the single statement of the direction of the wind at Annapolis, at 4 A. M.

Sixth position. "Wherever the wind set in from the N.E., it ought not to have changed at all, according to the centrifugal theory, whereas it did always change round by the N. to N.W. or W., or by the S. to S.W., as it should do by the centrifugal theory." p. 150.

One fact is truly stated in this position, viz. that this gale, wherever it "set in [or continued to blow] from the N.E.," "it did actually" "change round by the N. to N W. or W." But the alternative fact is not found, of a change [veering] from N.E. "by the S. to S.W., as it should [not] do by the centripetal theory." For this theory (supposing the course of the storm to be N E.) requires the wind to remain unchanged till the arrival of the central lull, after which the wind should come out, with even greater strength, from the opposite quarter; or, if the point of observation be just without the lull, the change should then be very rapid, as the lull passes, (see figures 1 and 2.) The averment, that "according to the centrifugal theory," meaning, as I suppose, the whirlwind theory, the N.E. wind "ought not to have changed at all," is not only unfounded, but appears as difficult to account for as any which is found in any of these positions; as will appear by the illustrations above referred to.

I object, however, to the term "centrifugal," as here used: for no one, I believe, except Mr. Espy, ever talks of the wind blowing *outwards* from the centre, towards the circumference of a storm. The idea of the wind's blowing directly inward, and thence upward, or downward, and thence outward in all directions, in violent storms, of either large or small extent, I consider as being fanciful, and wholly opposed to all correct observations, as well as to the laws of motion and equilibrium, which pertain to both the ocean and the atmosphere.

Seventh position. "According to the centrifugal [whirlwind] theory, the wind never could change round, on the extreme N.W. boundary, from N. N.E. to N.W., as it did, according to the centripetal theory." p. 150.

All the strength of this position lies in the assumption, here repeated, (see position first) that the points from which the gale was reported at N.

N.E., were "on the extreme N.W. boundary" of the storm, an assumption apparently as gratuitous and unfounded as could well be made. We have already noticed the general line on which the first violence of the gale was experienced from the N.E., and I can find its direction, at this period, mentioned as N.N.E. only as follows, viz. in one of the accounts from Norfolk, (p. 154) one from Bombay Hook, (ibid.) and possibly by constructive inference, at Point Lookout, at the entrance of the Potomac, (p. 158) and one also at Philadelphia, (p. 157.) But at *all* these places, we find that the same accounts, or others, state the gale to have been N.E., on which line of wind Mr. Espy locates the centre of the storm. The reader will therefore be surprised to find this line, where the wind veered to N., N. N.E., and N.N.W., assumed also as "the extreme N.W. boundary" of the storm, where "the wind never could change round from the N.N.E. to the N.W., as it did," according to *either* theory.

The mere absence of reports from more western localities, would afford no good ground for this position; for the gale raged with destructive fury on the line here mentioned, which could not therefore have been its extreme border. It is true, that we have found it stated in my reports, that there was no *hurricane* felt at Baltimore; but the direction of the wind having been from off the land at that place, as well as less violent, there was no injury received, nor any cause for reporting a remarkable storm. That the storm, however, was experienced at Baltimore, I have never doubted, for the contrary supposition would be of the most incredible kind. Besides, Baltimore is but little out from the line of New Castle, &c. through Chesapeake Bay to Point Lookout; and I find, also, the following accounts which have not improbably met the eye of Mr. Espy, as part of the first is comprised in his details of evidence at page 156.

Baltimore Sept. 6. "The steamboat Norfolk left here on Monday morning, at 9 o'clock, and when she opened the bay, [only twelve miles from Baltimore, and early in the day,] felt the gale severely; but being before [it] proceeded without fear. Off Point Lookout, [N. point of the entrance of the Potomac] fell in with ship Repeater, Maxwell, who had anchored before the gale. During the gale, parted her small anchor, and capsized, and was fast driving on shore, when it was thought advisable to cut away her masts. The Norfolk fell in with her, and towed her to Norfolk."

Another account says, the schooner Alert, Beers, rode out the gale under St. Mary's, Md., i. e. in the Potomac.

I may add also, that Mr. Espy, in admitting that on the extreme N.W. boundary the wind did change from N.N.E. to N.W., has effectually refuted his own theory, as applied to this storm. See figure 1.

Eighth position. "On the extreme S.E. boundary, it could not blow at all from S.E. according to the centrifugal [whirlwind] theory: but it did, according to the centripetal theory, blow in that direction in many places on that border." p. 150.

It is here correctly stated that this storm (if blowing in the form of a regular whirlwind at its extremities) "could not blow at all from S.E. on the extreme S.E. boundary of its path;" for a like reason, that according to Mr. E.'s hypothesis, it could not blow from N N.E. "on its extreme N.W. boundary;" but in here reiterating the assertion, (see first position) that "*it did*, according to the centripetal theory, blow in that direction in many places on that border, for six or eight hours during the whole strength of the gale," he appears to confute himself; for, 1st. The gale could not have exhibited this duration and "whole strength" upon its extreme border; for this would

be contrary to all our knowledge of this and other great storms; and 2d, we have already seen, that it was in places nearer to the centre of the storm where the gale set in at S E., and where its duration was not only six or eight hours, but, with vessels drifting before the gale, was eight and ten hours; *the duration of the gale being found greater on the line where it set in from nearly S.E. than on any other portion of its track;* as it should be, according to the whirlwind theory. On no hypothesis, therefore, could these places where the storm set in from S.E. and exhibited such strength and duration, have been at its "extreme S.E. boundary." Other evidence deciding this point has already been considered: (see under first position.)

Ninth position. "On the extreme N.W. border, according to the centrifugal [whirlwind] theory, it could not blow the hardest from the N.W., nor on the extreme S.E. border could it blow the hardest from the S.E., as it did in exact conformity with the centripetal theory." p. 150.

We have been showing that on the "extreme borders" here mentioned, "it could not blow the hardest," on any theory. The error or fallacy of the position, lies in again assuming for the "extreme border," the interior of the storm's path. But, by what process, or evidence, Mr. E. discovers that on these extreme borders, "it did blow the hardest" from S.E. and N.W., and "in conformity with the centripetal theory," I am at a loss to discover. The evidence of the manner in which the gale *did* blow, as we have seen, affords no support to this conclusion. This new fact, that the wind blew "the hardest" at the very point from which it first commences to blow, appears to be a more extraordinary discovery than any yet made.

Tenth position. "At Cape May it changed round from N.E. by E., and at Cape Henlopen it changed round from N.E. by N., in conformity with the centripetal, and entirely contradictory to the centrifugal, [whirlwind] theory." p. 150.

There is much error in this. 1st, A change of wind "round from N.E. by N," pronounced to be entirely contrary to the centrifugal [whirlwind] theory"! I forbear to comment on such a statement. But, 2d, can Mr. Espy inform us how this change from N.E. *both ways*, at or nearly on the same point or line of advance, can be in conformity with his centripetal theory? especially when we find from the reports that the central lull visited both places. We have seen, that on his hypothesis, the N.E. wind on the central line, supposing the storm moving N E., should not veer at all, but, at the expiration of the central lull, should come out at S.W. nearly, and this last wind having all the progressive force and velocity of the storm to aid it, should here blow with far greater fury than the previous N.E. wind. We are told, elsewhere, however, that the centre of the gale passed between these two points. But the diameter of the lull was such as to give a duration of half an hour at one place, and fifteen minutes at the other, moving with the velocity of 30 miles an hour. The fact alleged, therefore, cannot be known, and is also improbable; for according to the charts and Coast Pilot, Cape May bears from Cape Henlopen N.E. by N., distant but 12¾ miles, and the course of the gale being here N.N.E. nearly, would give a distance, *in the line of advance* between the two places, of less than three miles, while the diameter of the lull would appear, by these accounts, to have been at least fifteen miles.

At Cape Henlopen, "the gale commenced at half past 11 A. M. from E. S.E., and shifted in 20 minutes to E.N.E., blew very hard for nearly an hour, [evidently much longer,] a calm of half an hour then succeeded, and

the wind then shifted to the W.N.W., and blew, if possible, with still greater violence." Now, where do we find the wind, which, it is alleged, "at Cape Henlopen," changed round from N.E. by N., in conformity [?] with the centripetal theory." To show the error of this, I also add the following fact in relation to the direction of the wind at this place, viz. the pilot boat Oscar, Davis, of Wilmington, was driven ashore during the gale, about one mile S. of Cape Henlopen lighthouse, and the crew lost.* How could a *pilot boat* be thus driven on shore by a "N.E. wind changing round by N."?—or even by an E.N.E. wind. Can Mr. Espy inform us?

The mean of the accounts from these two capes, as before suggested, is probably an approximation to the true state of facts; and that the gale was not N.E. at these places, seems also apparent from the report from Morris River in the lower part of Delaware Bay, (N. J, and not Del., as previously given,) which states the gale there was "from E.S.E." And at Dennis' Creek, in the same vicinity, according to the reports collected by Mr. E., "the wind came on to blow about 2h. from the *eastward*, and continued to increase till about 5 P. M., when the wind *changed to the westward*, still blowing very heavy," (p. 157.) I also find reported from Mount Holly, in the interior of New Jersey, between the Delaware and the sea coast, a "heavy rain, with violent *east wind*" (N. Y. Gaz., Sept. 8.) These facts serve to show, most conclusively, that the line of N.E. wind was not over the Capes of Delaware, as claimed by Mr. Espy.

The errors here involved have also been shown in the refutations of the third, fourth, and seventh positions.

Eleventh position. "Both in Norfolk and New York, the wind set in from near the N.E., and at the termination blew from S.W., which is the experimentum crucis in favour of the centripetal theory, and utterly inconsistent with the other. [?] In like manner at Ocracoke, it set in at E.S.E., and terminated at S.S.W.; and out at sea, on the extreme eastern borders of the storm, the wind blew for eight or ten hours from S.E. and S. by E., with but little change, as it ought to do, if the wind does actually blow towards the centre of the storm." p. 150.

We shall find, that the setting in of the wind "from near N.E." at New York, does not very clearly appear; and it would seem to have been *after* the termination of the gale at the above places that the wind blew from the S.W. The important fact, that at these places the gale veered by the N., and blew its greatest strength before passing the N.W. point, is kept out of view, and appears fatal to the centripetal theory and its "experimentum crucis." The wind reported at Ocracoke "from E.S.E. hauling round to S.S.W.," accords with the regular whirlwind action of the storm, provided its centre passed inside of that anchorage, as it probably did, and from thence to sea across Currituck Sound, the line of progress here being N. or westward of that point; although it does not appear whether the phrase *hauling round* is used in its proper sense, or to express a more abrupt and general change of direction. We again find here, also, the singular assumption which has already been disposed of, and which, as now presented, amounts to this; that an undefined point of observation, which would appear to have been moving to the northward and westward before the gale and the Gulf Stream, so as to carry the gale for eight or ten hours with but little change, was actually "*in the extreme eastern border of the storm!*" Infer-

* N. Y. Gazette, Sept. 8.

ences drawn from such positions as these, would seem to require no further refutation.

Twelfth position. "At the time the wind changed round to S.S.W. at Ocracoke, it was blowing at Norfolk a violent gale N.E., nearly towards Ocracoke. Now, as these places are 130 miles apart, and nearly on opposite sides of the storm at that moment, it is utterly impossible, according to the whirlwind theory, that the wind at Ocracoke should be blowing towards Norfolk, and, at the same time, the wind at Norfolk be blowing towards Ocracoke. And this fact is entirely consistent with the centripetal theory."

We have here, if I mistake not, a further specimen of the manner of confounding, or passing over, the essential distinctions of time, place, and direction, for which Mr. Espy's meteorological papers are so remarkable. The evidence laid before us is this: "At Ocracoke, at daylight, wind E.S.E., blowing a gale; *after* hauling round to S.S.W., ceased between 10 and 11 A. M., both at Ocracoke and Portsmouth." At Norfolk, after 10 A. M., the wind *commenced* blowing a gale from N.E.; from 11¼ to 12½, it threatened a general demolition; about 12, the wind shifted to N.W., [one other account mentions the wind as changing from N.N.E. to N.N.W.,] and *continued* its fury half an hour longer; and at 4 o'clock, *the storm was over*, and the wind changed to S.W." The italics here are mine.

Now, 1st, as to time: The storm, it appears, ceased at Ocracoke between 10 and 11, and of course it blew from S.S.W. *before* this period, if at all; while at Norfolk the gale *commenced* blowing at N.E. *after* 10 o'clock. So much for the winds of this hurricane blowing at these two places "at the same time." 2, As to place and direction: a N.E. wind moving in a direct course from Norfolk for the distance of 130 miles, as protracted on Blunt's Chart, *would reach a point 120 miles W.N.W. from Ocracoke bar or inlet;* and this is called "blowing at Norfolk nearly towards Ocracoke"! We thus see, that the assumptions which are here made, fail altogether; but it will also be perceived, that there was sufficient time and space for the wind of the N.E. storm at Norfolk to turn towards the left, around the rapidly advancing axis of the whirlwind storm, without sweeping so far south as Ocracoke.

(TO BE CONTINUED.)

Progress of Practical and Theoretical Mechanics and Chemistry.

ARTICLES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

Salts Arising from Organic Bodies. By M. V. REGNAULT.

In an elaborate memoir entitled "New Researches on the Composition of Organic Alkalies," it is stated by the author, in his conclusion, that "the preceding analyses show very clearly that all salts formed from organic bases with oxacids, include one atom of water necessary to their composition, and of which they cannot be deprived without undergoing decomposition. These bases, therefore, present a complete analogy with ammonia in its mode of action with acids. They combine directly with the hydracids without decomposition, forming hydrochlorates, and not chlorides, like

the mineral oxybases; and with oxacids dissolved in water, the vegetable bases unite by fixing one atom of water which enters into their intimate composition. The partisans of the theory of ammonium must admit an analogous theory with respect to the vegetable alkalies. Under this point of view it would be very interesting to study the action which anhydrous oxacids exert upon dry bases. But difficulties would here be met with greater than in the case of ammonia, arising particularly from the unstable nature of these bases and the great complexity of their composition. I have, however, commenced some experiments with the view to ascertain what takes place when dry bases are saturated with sulphurous acid.

It is remarkable that the azotized basic substances, of so interesting a character, latterly brought into view by M. Leibig, include one atom of water in many of the salts which they form with oxacids. It is highly probable that their oxysalts have an analogous composition.

Finally, urea, which, from the totality of its properties, cannot be considered as any other than an organic base, makes no exception to this general mode of composition, as I have ascertained by the analysis of the oxalate and nitrate of urea which have hitherto been regarded as anhydrous.

Ann. de Chim. et de Phys. Juin, 1838.

New Dropping Tube, (Pissetta.) *By* A. Levol.

I use for washing filters, a very simple dropping tube, which appears to have some advantages over those commonly employed. It is composed of a straight tube drawn to a point at its upper end, the other passing through the cork of a vial containing water, in the ordinary way; but I add a bent syphon tube, one of whose branches reaches the bottom of the vial, the other being outside. It is evident, that when the vial or flask is inverted, the flow will be in proportion to the height of the column of water, and that it may be accelerated by blowing through the outward branch of the syphon. This little apparatus (which allows us the use of hot water) has been recommended in the School of Mines. Idem.

On a New Electric Condenser. *By* M. Peclet.

This new condenser is composed of three plates of glass, roughened by rubbing the surfaces carefully one upon another. They are entirely covered with gold leaf pasted on with alumine. One of these plates, A, is fixed to a common gold leaf electrometer, its upper surface being varnished. The second, B, is placed on the first; it is varnished on both sides; a small, gilt, unvarnished, copper stem is fixed horizontally at a point in the circumference; it carries in its centre, like the movable plate of common condensers a glass stem, which serves as a handle. Finally, on this last plate is a third plate, C, with a hole in its centre, through which passes the stem of the plate B. The plate C, is varnished on the under side only, and its central orifice is furnished with a glass tube which encloses the stem of the plate B, but of a less height.

This apparatus is used as follows: we touch the upper plate with the metal whose action upon gold we wish to determine, and put the plate B, in connexion with the ground:—this connexion is then broken, the plate C, is raised, and we touch the plate A. This manœuvre is repeated a certain number of times. Lastly, by means of the stem of plate B, we raise at

once the plates B, and C; when the gold leaves of the electrometer diverge to a distance dependent on the number of contacts.

The cage which incloses the gold leaves is formed of parallel glass plates, and is placed on a screw tripod, furnished, on one side, with a vertical plate, pierced with a small hole, and on the other with a portion of a divided vertical circle, whose centre is at the same height as the hole of the plate and the upper extremity of the gold leaves: in looking through the hole of the plate we observe the deviation.

To give an idea of the power of this apparatus, I will mention two series of experiments. By touching the upper plate with an iron wire after 1, 2, 3, 4, 5, and 10 contacts, the leaves separated $9\frac{3}{4}$, 20, 25, 31, 41, and 88°. By touching the upper plate with a platina wire, a single contact produced but a feeble deviation, which increased to 15° after three contacts, and to 53° after 20. The experiments with platina were made by using a platina wire which had just been reddened in the flame of alcohol, after washing the hands in distilled water. I had previously assured myself, by a great number of successive contacts in which I touched the upper plate with a finger, that the plates did not contain any electricity.

The new fact of the development of electricity by the contact of gold and of platina, was also directly proved by means of a simple condenser of extreme sensibility obtained by giving to the coats of varnish a suitable thickness, and rendering their surfaces perfectly plane.

By means of the double and common condenser, I have ascertained that all the metals on which I have operated were positive with respect to gold, and that arranged in the order of their electromotive faculty, in this respect, were ranked as follows:

Zinc—lead—tin—bismuth—antimony—iron—copper—silver—platina.

The effects produced by bismuth, antimony, and iron, are with difficulty distinguishable.

It is evident, from the disposition of the apparatus, that the quantity of electricity set at liberty, which causes the divergence of the leaves, is proportionate to the number of contacts; now it results from numerous experiments, that as far as about 20° the deviation is proportionate to the number of contacts, hence to this extent the deviation is proportionate to the quantity of electricity. It would be easy to make a table which would give the quantity of electricity corresponding to the deviations which exceed 20°, since these quantities are proportionate to the number of contacts.

Simple condensers, or multipliers, cannot, however, serve to determine the relation of the effects produced by the contact of gold and of different metals, since their relations vary with the thickness of the coats of varnish, as I have satisfied myself by a comparison of experiments with different apparatus.

The instrument which I have the honour to present to the Academy, possessing a sensibility in some sort indefinite, presents to physics a new means of investigation, which I hope may contribute to throw light upon the singular phenomena produced by the contact of bodies. Idem. Aout, 1838.

On the Temperature of the Earth in Siberia.—Extract of a Letter from M. Erman *to* M. Arago.

I venture to flatter myself that you will take some interest in the passages of my journal which relate to the climatology of Northern Asia. I

resumed my researches at the town of Jakoutzk. The bottom of a hole, which M. Scherguin, a merchant of that place, had dug to the depth of 50 ft. English, (with the hope of reaching an unfrozen stratum, whence water might be obtained, maintained the temperature, during the whole of my trials of it, of—6° Reaumur (= + 18° 5′ Fahr.) The temperature of the surface could not have surpassed that degree; though the place of observation was in lat. 62° 1′ 29″. This result appeared to me very paradoxical, but I have since proved it by observations on the temperature of the air in the same town, during several consecutive years, with thermometers which I have carefully compared with my own. The following are some of the results:

Temperature of the air in the town of Jakoutzk, during the year 1827,* in degrees of Fahrenheit.

Mean Temp.	6 A. M.	2 P. M.	9 P. M.
January,	— 33°	— 31°	— 32°
February,	— 44½	— 36	— 42
March,	— 17	+ 1.6	— 8
April,	+ 8	+ 30½	+ 17
May,	+ 36	+ 47	+ 38
June,	+ 59	+ 68	+ 54
July,	+ 64	+ 80	+ 62
August,	+ 57	+ 73	+ 58
September,	+ 39	+ 50	+ 40½
October,	+ 11	+ 21	+ 13
November,	— 13	— 9	— 18
December,	— 43	— 40	— 42

You will conclude, from these observations, that the mean temperature at Jakoutzk perfectly agrees with that of the upper strata which I had observed at the depth of 50 feet. It necessarily follows, that by digging deeper they need not expect to come to unfrozen ground, until an increase of heat is obtained, arising from an approach towards the centre of the earth, and amounting to 6° of Reaumur, (=13° 5′ Fahr.) The experiments hitherto made in the wells of exploration in Europe, and those made by myself in the Oural Mines, make this increase equal to 1° Reaumur for 90 to 100 French feet. I should not expect, therefore, to find unfrozen ground at Jakoutzk under a depth of 500 to 600 feet. The observations which M. Scherguin has made since my departure from Jakoutzk, and when they had extended the digging to 400 feet English, perfectly confirms my previous remarks; for they have found that

At	77	feet English,	temperature	— 5.5 R. = 19.6 Fahr.
	119	"	"	— 4.0 = 23°
	382	"	"	— 0.5 = 31°

but these trials indicate that in this country an increase of 1° R. requires a depth of about 60 feet English, which is a more rapid increase than in lower latitudes.

This is to be attributed, I apprehend, to the higher conducting power of the strata of Northern Asia than of those which we inhabit. In fact, the

* This was a temperate winter, for in 1828, the cold of January was

	6h. A. M.	2 P. M.	9 P. M.
Jan. 1828	— 54 Fahr.	— 48	51

excessive variations of temperature observed at Jakoutzk and other places in Eastern Siberia, during the course of a solar year, induce us to admit that the surface of the earth is there endowed with a radiating and absorbing power much superior to that of Europe.* Idem. Sept. 1838.

Rapid Mode of Reproducing One's Thoughts.

Doctor Desrivieres points out the following process. Take a thin sheet of lead, or other ductile metal, place it on a smooth hard table, and write upon it with a fine style, with a smooth blunt point, so as to raise the letters in good relief on the under side. A paste of any kind, or plaster diluted with water, is then used to fill the hollows formed by the style. When the paste, or plaster, is hard, the plate is turned over on a hard plane surface, an inked roller is passed over the raised letters, moist paper is then laid on it, and in defect of a little press, it may be struck with a fine brush.

Rec. Soc. Polyt., July 1838.

The Artesian Well at the Abattoirs of Grenelle, Paris.

This well has now a depth of 418 metres, (= 1371 feet.) The sound, or borer, weighs 20 thousand; its height is treble that of the dome of the Invalides, and it requires two machines of immense power to put it in motion. The instrument is still in the chalk bed, the hardness of which is comparable to flint. M. Mulot, the director, states that the sound advances a foot per day. Idem

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Examination of Sea Water Collected during the Voyage of the Bonite, with Apparatus Invented by M. Biot. By M. Darondeau.

Five specimens of sea water, obtained at different places and depths, were brought in bottles with ground stoppers. They were only two-thirds full, because the bottles were of a greater capacity than the receiver of the apparatus. Five other specimens, taken from the surface and enclosed in like manner, filled the whole capacity of the bottles. One of these was broken on its way from Brest to Paris.

All the water taken at the surface was perfectly limpid; but that which came from beyond a certain depth contained a whitish flocculent matter held in suspension.

The experiments were all made in the laboratory of the College of France, under the eye and direction of M. Fremy. The density of the water was determined by a specific gravity bottle, comparing the weight of the sea water with an equal volume of distilled water at ascertained temperatures. The quantity of gas held in solution was made known by boiling a flask entirely full of the water, and receiving the gas over mercury. The carbonic acid was determined by potash, and the oxygen by phosphorus.

To ascertain the quantity of saline matter, Gay Lussac's process was followed by evaporating to dryness a given weight of water in a mattress of known weight, inclined at an angle of 45° to prevent loss by projection. The residuum, heated to dull redness, gives the saline matter, minus the chlorohydric acid arising from the decomposition of chloride of magnesium by the heat; but this was accounted for by determining the magnesia in the

* Journ. Frank. Inst., vol. xxii., p.p. 118, 286.

residuum and replacing its oxygen by an equivalent of chlorine. The following are the results:

Time and Place of taking Water.	Latitude.	Longitude.	Depth.	Density at 8° & 10° Cent.	Saline Residue in 100 Wat.	Gas in 100 parts Water.*	Composition of 100 parts Gas.		
							Oxygen.	Azote.	Carbonic Acid.
30th August, 1836. Pacific Ocean,	11° 8′ N.	108° 30′ W.	Surface,	1.02594	3.429	2.09	6 16	83.33	10.51
			70 fath.	1.02702	3.328	2.23	10.09	71.05	8.06
19th March, 1837. Gulf of Bengal,	11 45 N.	87 18 E.	Surface,	1.02345	3.218	1.98	5 53	80.50	13.97
			200 fath.	1.02663	3.491	3.01	3.29	38.5	58.15
10th May, 1837. Gulf of Bengal,	18 0 N.	85 32 E.	Surface,	1.02611	3.378	1.91	6.34	80.34	13.32
			300 fath.	1.02583	3.484	2.45	5.72	64.15	30.13
31st July, 1837. Indian Ocean,	24 5 S.	52 0 E.	Surface,	1.02577	3.669	1.85	9.84	77.70	1246
			450 fath.	1.02739	3.518	2.75	9.85	53.23	34.92
24th August, 1837. S. Atlantic Ocean,	30 40 S.	11 47 E.	400 fath.	1.02708	3.575	2.04	4.17	67.01	28.82

* Temp. 0° Cent. Pressure 760mm.

The table shows that generally the density at the surface is less than at a certain depth; in one case only, the water, at 300 fathoms, in the Bay of Bengal, had less density than the surface water, the difference being $\frac{3}{10000}$.

Generally the saltness was greater below than at the surface; in one case, however, it was less. These results seem not to be inadmissible, for there is a great difference between the temperature of the water at the surface and that at 800 or 400 fathoms.

The table shows that the surface water contained, in all cases, less air than that at a certain depth, and that the difference may amount to $\frac{1}{100}$ part of the volume of water.

Deep water also contains more carbonic acid than that at the surface. Does this gas exist ready formed in the water, or did it arise from the decomposition of the flocculent matters found in all the bottles of water from a great depth? This could only be determined by analysis made on the spot. We shall be always led by the use of Biot's apparatus, to confirm, perhaps, one of these two facts, equally remarkable: 1st, That sea water, at a certain depth, holds in solution a greater quantity of carbonic acid than that at the surface; or 2d, That at this depth it includes transparent animalcules, or at least an organic transparent substance, not found at the surface, and which is decomposed by degrees, depriving the air, held in solution by the water, of oxygen to form carbonic acid.

In the latter case, the proportion of oxygen in the acid from deep water, must be more considerable than that at the surface, for its free oxygen, added to that of its carbonic acid, forms, with the azote, a more oxygenated air than that of the atmosphere; whilst, in the former case, the free oxygen, and that of the acid, forms, with the azote, an air differing very little in composition from atmospheric air.

In our experiment made on board the Bonite, water from 380 fathoms, contained 1.62 of gas to 100 of water; and in two other experiments, water from 300 fathoms contained 2.20 and 3.89 of air to 100 parts of water. The air was not analysed.

Ann. de Chim. et de Phys., Sept. 1838.

Improved Mode of Magnetizing.

Captain Scoresby, in a letter to M. Arago, informs the latter that he had constructed a magnetic bar composed of 196 plates of steel tempered to the greatest degree of hardness, and 15 inches long. It had six times more energy than the bars he had previously formed of steel tempered in the usual manner. With this compound bar he had magnetized, by influence, or induction, at the distance of 11 inches, a polished soft iron nail, weighing 500 grains, so that this nail in its turn supported another weighing 389 grains. This bar would support, through a slab of marble, 7-8ths of an inch thick, a nail weighing 194 grains.

To bring the magnetic agency to its highest degree of power, Captain Scoresby uses steel of the greatest possible hardness, which allows the force to accumulate almost indefinitely. The following rules are laid down by this very skilful magnetician in his letter to Arago:

1st. A single bar, or plate, is stronger, *in proportion*, than two bars together, of the same dimensions, temper, quality and mass.

2d. A combination of bars, or magnetic plates, is always more energetic than a simple bar of the same steel, temper, form, or mass.

3d. The absolute increase of magnetic power in compound needles, diminishes gradually in proportion to the number of bars.

4th. Continual additions to a powerful combination of plates, or bars, cease to be advantageous beyond a certain limit, on account of the impossibility of obtaining a numerous series of pieces perfectly identical. Weak plates (whether inferior in quality or temper) not only add nothing to the force, but sometimes, their polarity being reversed, they produce a real diminution of strength in the whole system.

5th. A certain deterioration takes place in the permanent individual strength of all the bars in the compound at each addition of strength which the whole system receives. This change varies with the temper of the bars.

6th. Another loss of *temporary* force takes place in powerful compounds, so that a plate which preserves some strength when withdrawn from the system, may be neuter, or even have its poles reversed, when it makes part of the combination.

7th. The excess of strength in a combined system is greater when the bars do not touch each other. This augmentation increases when the space between the plates is enlarged.

8th. A greater number of plates may be combined with advantage if kept separate, than when in contact. The weakest plates become, under this arrangement, the most active.

9th. A partial separation, in the middle of the plates for example, the extremities being in contact, has some advantages over a contact throughout. The value of this advantage has been determined by experience.

10th. For the most advantageous combination of the plates, it is necessary to temper, not simply the extremities, but the whole length of the bar.

11th. Very thin plates (like those 2 feet long, and .042 inches thick) are susceptible of the greatest development of force, even separately, when tempered throughout their whole length.

12th. Thicker plates, and of certain proportions, on the contrary, receive separately a higher power when tempered only at the extremities, and not in the middle.

13th. Plates tempered in the coarsest manner are those which lose the least proportion of their force by combination. Thus, though their magnetic capacity be less than that of plates less tempered, their absolute power in a numerous combination is greater.

14th. The permanence of the magnetic state in a compound system, if left without a conductor or armature, is at least as high as in simple bars. It is decidedly the greatest when the plates are not in contact. Idem.

On the Action of Alkaline Solutions on some Metals. By M. Vogel, *of Munich.*

M. Payen published some years ago, an interesting memoir in which he showed that alkaline fluids preserved iron and steel from rust. Water containing from $\frac{1}{300}$ to $\frac{1}{2000}$ of an alkali has this property, and carbonate of soda, borax, and lime water, preserve steel much in the same manner as the alkalies.

The author of the present memoir goes into a careful examination of this subject, and thus sums up the result of his investigations:

1. That iron and steel may be protected from rust by weak alkaline solutions.

2. That steel bars preserve their metallic lustre in them, even when in contact with each other.

3. That the absence of air is not the cause of the steel being preserved from oxidation.

4. That antimony and nickel do not lose their splendour in weak alkaline solutions.

5. That bismuth acquires in them a brass yellow colour, and afterwards turns purple.

6. That zinc and cadmium acquire in them a grayish yellow coat.

7 That lead and tin are attacked by these solutions; the lead is covered with a carbonate, and deutoxide of tin is formed.

8. That copper is attacked more rapidly in weak alkaline solutions than all the other metals. Its oxidation is also accelerated in concentrated solutions.

9. That brass becomes black, while an alloy of copper and nickel retains perfectly its metallic brightness.

10. That potash and soda dissolved in much water, appear to produce the oxidation of copper by a *catalytic** influence.

11. Finally, that copper may be bronzed by alkaline solutions.

Journ. de Pharmacie, Sept. 1838.

Boots and Shoes Sewed with Wire.

M. Sellier of Paris, has secured by a patent in France the right of using brass wire for attaching the upper leather to the welt of shoes and boots. He urges that this metallic thread allows neither moisture nor dust to enter the shoe, and furthermore that it does not rip. The sewing is performed with as much ease, as with a waxed thread, nor is the work more costly. A member of the committee has worn a pair of Sellier's boots 18 months, in which time two strong soles were worn out, without any giving way whatever of the wire sewing. They were free from dampness, and from dust in a time of drought.

Bull. d'Encour. Sept. 1838.

Note on the Employment of the Method of James Marsh, *in a Case of Legal Medicine. By* F. Thinus, *Pharmacien at Fontainebleau.*

On the 26th of last May, M. Mollier and myself were requested to subject to chemical analysis, the stomach and part of the small intestine of Lady D****, who died suddenly. Public clamour accused her husband of having poisoned her.

We were not long in discovering the presence of arsenious acid in these vessels, and in the fluid which they contained; and after having obtained the arsenic in a metallic state by the ordinary processes, we wished to make use, also, of the method of Marsh† for the same purpose.

A portion of the fluid taken from the stomach was acidulated with sulphuric acid and a piece of zinc placed with it in a tubulated flask, to the tubulure of which was adapted a fine pointed tube. After a few moments, the gas was inflamed, when a piece of porcelain being held over it, a coating of metallic arsenic was obtained, but the fluid swelled, and rose in the tube so much, that it was impossible to continue the operation.

* Journ. Frank. Inst. vol. xx., p. 144. † Idem, vol. xviii., p. 338.

We then had recourse to Marsh's apparatus, and as the scum prevented a continuous flow of the gas, we allowed it to accumulate in the short branch of the tube, and opened the cock only when the froth had disappeared. This was expedited by moving a piece of ignited coal round the tube, bent at right angles about three inches above the cock to which it was adapted. This tube was heated to redness in the middle of its horizontal part.* A quantity of arsenic, quite considerable, was here deposited; and the extremities of the tube being sealed by a lamp, the specimen was easily preserved. This last method of decomposing arsenical hydrogen is unquestionably the best, for no portion of the gas is lost, and by continuing the operation, we obtain within a short space almost the whole of the arsenic contained in the substance to be analysed; and if we are careful as soon as the operation is over, to close the end of the tube, the arsenic preserves indefinitely its metallic brilliancy when exposed to the air.

We were given also some fecal matters to examine, which we had only to boil for a few moments in distilled water, to obtain, by the above process, results which were very satisfactory.

I ought to mention, that we rigorously examined the purity of the sulphuric acid and the zinc employed in the investigation, and after each operation we changed the zinc, lest some arsenic might be deposited on it.

My only object in this note is to recommend the process of Marsh as the most eligible for its simplicity, ease, and the certainty of its results. Our application of it is the first, I believe, in so grave a case of medical jurisprudence.

D*** was found guilty of poisoning his wife, and condemned to death on the 23d of August last, by the court of session of Seine and Marne.

Journ. de Pharmacie, Oct. 1838.

New Cyanuret of Iron. By M. Pelouze.

This is obtained by passing an excess of chlorine through a solution of cyanoferride of potassium, allowing the liquid to repose, or, which is better, to heat it to ebullition. A light, green, insipid powder is deposited, mixed with oxide of iron and Prussian blue. Treated with eight or ten times its weight of boiling hydrochloric acid, which destroys the Prussian blue, and dissolves the oxide of iron,—washed and dried in a vacuum, it constitutes the new cyanuret.

Idem. Nov. 1838.

Analysis of Several Bituminous Minerals. By M. P. Berthier.

As bituminous substances have of late years claimed an increased share of public attention, this celebrated analytical chemist has examined the constitution of a number of those which have gained the most notice on account of their practical applications.

Bitumen of Seyssel. There are at Seyssel, (in the department of L'Ain) three kinds of minerals.—1. The sandy mineral. 2. The very fusible calcareous mineral. 3. The calcareous mineral of difficult fusion.

The *first* of these melts in boiling water, and becomes detached from the stony matters to which it was adherent. It rises to the surface, or sticks

* Journ. Frank. Inst. vol. xviii., p. 338. † Id. vol. xxii., p. 383.

to the sides of the vessel in brown lumps, or forms a transparent coating of a brownish red colour. A rich specimen of it gave

Bituminous oil	.0.86	bitumen .106
Carbon	.0.20	
Quartzy grains	.690	
Calcareous grains	.204	
	1.000	

In the mass it is much less rich. When purified by hot water, this bitumen is called *la graisse*, grease.

The *second* variety is called at Seyssel *asphaltum*. It may be pulverized and sifted, but the powder spontaneously forms into balls. The specimen analysed contained .11 of bitumen, 5.89 of carbonate of lime, without clay, and quite pure.

The *mastic* of Seyssel is prepared by mixing nine parts of *asphaltum* with one of the pure *grease* extracted from the sand.

The *third* variety is a compact limestone, in extremely thin, parallel beds.

It consists of

Bituminous matter,	.100
Argil,	.020
Sulphate of lime,	.012
Carbonate of lime,	.868
	1.000

The bituminous mineral of *Belley* is very similar to the preceding. It is found in several communes in very considerable quantities, near the surface of the ground. It is of variable quality. A variable specimen yielded

Carb. of lime,	.824
Carb. of magnesia,	.020
Sulphate of lime	.013
Argil,	.023
Bitumen,	.120
	1.000

Bitumen of Bastennes. This bitumen flows out from several openings or springs, mixed with water. Analysis of the solid gave

Oily matter,	.200	bitumen
Carbon,	.037	
Fine quartzy sand, mixed with argil,	.763	
	1,000	

Bitumen of Cuba. This is transported to Europe under the name of *Mexican asphalt*, or *chapopote*. It is a solid bitumen, which exists in abundance near Havana. It may be used with great advantage in paving. It consists, like the greater number of natural bitumens, of at least two different substances, the one soluble and the other insoluble in ether and spirits of tur-

pentine. It is the relative proportion of these two substances which imparts to each bitumen its peculiar properties.

Bitumen of Monastier (Haute-Loire.) This does not soften in the least in boiling water, and hence cannot be extracted by simple means in the large way. It contains.

Bituminous oil,	.070	.105
Carbon,	.035	
Water,	.045	
Gas and vapours,	.040	
Quartz and Mica,	.600	
Ferruginous argil,	.210	
	1.000	

This bitumen of the Haute-Loire differs essentially from those of Seyssel and Bastennes by its infusibility in boiling water, and its fusibility in alcohol.

Annales des Mines, tom 13, liv. iii.

On the Red Colour of Salt Marshes. By M. Payen.

When sea water is subjected to spontaneous evaporation, the commencement of the deposition of salt is known by the appearance of a light red scum. A reddish tint is observable also in the salt when collected in heaps, and it then emits an odour somewhat like violets. This colouring is occasioned by little crustaceous insects of the order of branchiopodes, and genus *Artemia*. These little animals, about a third of an inch long, have the form of a very thin cylindrical or vermicular tube, furnished with two little antennæ and two round and elevated black eyes, with a narrow mouth under the eyes. They have 22 swimming legs, which take up half their length. They move with prodigious rapidity, but perish when the solution acquires the density of 25°. Their bodies then become red, and float over the surface in the form of a scum.

Idem.

Copper in Cuba. By P. Berthier.

A French merchant has just brought from Cuba specimens of a metallic substance which may be obtained, as it appears, in very great quantities. I have found it to consist of melted sulphuret of copper, absolutely pure. Though it contains neither gold nor silver, it would be an excellent object of commerce, because it would be extremely easy to extract from it the 80 per cent. of copper which it contains.

Idem.

Analysis of two Micas, with Bases of Potash and Lithim. By V. Regnault.

These micas swell easily at a red heat, without any sensible loss of weight, and are then easily pulverized.

Lepidolite rose Mica. This mica is presented under the form of very small rose coloured spangles. It is found disseminated in a keolin used in the porcelain works of Vienna, in Austria. It is separated in the levigations which the clay undergoes.

Composition.

Silica,	52.40
Alumina,	26.80
Deutoxide of manganese,	1.50
Potash,	9.14
Lithim,	4.85
Fluor,	4.40
	99.09

Yellow Mica. In large leaflets of a fawn colour.

Composition.

Silica,	49.78
Alumine,	19.88
Peroxide of iron,	13.22
Potash,	8.79
Lithim,	4.15
Fluor,	4.24
	100.06

Abstracting the fluor, the formula of these two micas is therefore

$$\dddot{(Al, Fe)}\ \dddot{Si} + \dddot{(K, L)}\ \dddot{Si}.$$

The mode of analysis is given by the author.

Annales des Mines, tom. xiv. p. 151.

Means of Reducing the Price of Public Clocks. By W. Wagner, *of Paris.*

A report by M. Francœur, on behalf of the Committee on the Mechanic Arts of the Societé d'Encouragement, attests that the committee is persuaded of the utility which the public will find in the fabrication of the new clocks of M. Wagner, rue du Cadran; that they perform with exactitude and safety, and that the execution is in all parts complete.

The reporter remarks that the expense of at least from 1000 to 1200 francs is an obstacle to many churches, manufactories, and large edifices in the procuring of a public clock, and suggests that the reduction of price by M. Wagner to 3 or 400 francs, wherever there is a clock on which the hours may be struck, may open the way for overcoming it. At Moret there is a manufactory of what are called *Jura clocks*, in which all the pieces of the mechanism are made in the large way, and all made to fit; wheels, weights, bells, dial plates, hands, hammers, &c. are made, set up, and delivered in the market for 40 francs, and the clock goes very well. This great establishment has changed the face of the surrounding country, increasing the population, the erection of new buildings, and the general prosperity. The Jura clocks are acknowledged to keep as good time as can be expected from works of this kind, especially when the escapement, as is done by Wagner, has been retouched.

This apparatus is transformed by Wagner into a public clock, which strikes the hours on any required bell, by a hammer proportioned to its size. This is done by adding to the Jura clock a mechanism which answers the desired purpose.

To comprehend the play of this mechanism, imagine an addition to the Jura clock, consisting of a heaving striking weight, hammer, and fly to moderate the descent of the weight, and a very simple mechanical connexion of these with the clock. A lever retains the heavy weight, which lever is held in its place by the wheel work of the common striking part of the clock. As soon as the hammer of the clock is set free to strike the hour, the lever which holds the heavy weight is freed, and by the descent of the latter the great hammer is set in motion, and which, as a consequence, will strike as many blows as the hammer of the clock. Thus as many strokes will be heard on the great bell as the clock itself strikes, which has no other action on the mechanism connected with the great bell than to give it leave to speak. The hour will thus be struck twice, which is not an advantage to be despised, since it costs nothing, and is often useful.

A large dial plate and hands must be added to the Jura clock, adapted to its height or distance to be seen. The great number of public clocks, constructed on this principle leaves no doubt of the utility of the invention.

Idem. Oct. 1838.

New Mode of Preparing Carburetted Hydrogen for the Purpose of Illumination. By M. Selligue, *Engineer.*

This new invention has gained for M. Selligue the premium of 2000 francs proposed by the Societé d'Encouragement. It consists in obtaining pure hydrogen by decomposing water by means of incandescent charcoal, and then carburizing it by mixture during the simultaneous decomposition of another liquid substance rich in carbon and hydrogen. Among all known substances, that which appears to answer best is the oil of schist, (l'huile de schiste.)

The furnace is composed, 1st, of three vertical retorts, communicating with each other, so as to form, in a manner, only one. In a double furnace there will be six retorts. These are all open at both ends, but closed below by sliding stoppers, (*couvercles rodés*) so that simple contact and the least pressure is sufficient to shut them firmly. The top of each retort is closed by a head fixed by keyed gudgeons and iron cement. Each head bears itself a stopper, or cover, like those below.

The first retort into which steam is introduced through a tube, communicates below, by a tube twice bent, with the second, which connects at top with the third by a similar tube, and this third retort has, below, a vertical tube with branches, by which the gas is conducted to a refrigerator, and thence to the gasometer. This tube dips into a trough of water, to serve as a hydraulic closure. The third retort bears at top a funnel syphon, through which the carburizing substances are introduced. 2d. Two horizontal tubes, placed in the sides of the vault, serve as boilers to vapourize the water; each communicates at one end with the first retort by an arched tube, and to the other end is attached a funnel syphon, by which the boiler is supplied with water. 3d. Two furnaces. 4th. A chimney in four parts, uniting at first into two, and then into one, in order to regulate the fire with greater ease.

Operation.

Having filled with charcoal the first two retorts in each of the (double) furnaces, and suspended chains in the two last, in order to increase the surface, the fire is lighted, and when the retorts have attained a cherry red

heat, a gentle flow of water and oil is made through the syphons. The water falling into the boilers is instantly evaporated, passes into the first retort, then into the second, where it is deprived of its oxygen, and reaching the third, the hydrogen alone mingles with and carries along the carbonated hydrogen simultaneously formed from the oil in the last retorts. The united gases then issue from the lower end of the third retort, and press off through the branches, while the more volatile matters are deposited in the reservoir of water. Idem.

New Steam-boat Enterprise.

A company has been formed for a steam-boat communication between Vienna and Smyrna, by the Danube, the Black Sea, and the Straits. Passengers whose business calls them into Austria, and who have no occasion to stop at Moldavia or Walachia, will not be subject to quarantine at Galatz, and only 5 days at Orsova. It was necessary, before this route was established, to submit to 24 days quarantine, i. e. 14 at Galatz, and 10 at Orsova. Rec. Soc. Poly. Juil. 1838.

Elastic Boots with Movable Heels. By M. Quenet.

This invention has been patented. While the patentee preserves the entire elegance of the form of the boot, he has discovered the means of preventing the pain arising from the swelling of the foot. By a slight pressure on the bolt of a spring, the whole shoe may be lengthened about 12 lines. It is very convenient for those who in walking press harder on one side than the other. The mobility of the heel, and its peculiar structure, cause it to wear equally in all parts. Idem.

Fonvielle's Filtering Apparatus.

A trial has been had in the Courts at Paris, relative to the validity of the claims of the "French Filtering Company," who are now the possessors of Fonvielle's patent, to an exclusive right, founded on the merits of this invention. It was urged by the opposing party, that this right, being dependent on the application of high pressure, is invalidated by the fact of a prior use of the same principle to the process of filtration, as was shown by brevets (patents) of an anterior date. This plea was answered on behalf of the Company, by the proof that Fonvielle's mode of applying high pressure was entirely different from those of his predecessors. These were to force the water through *tissues of felt, wool, or flax, or through skins*, while Fonvielle's consists in filtering *through sand, pounded stones, gravel, and other inert animal substances*, which is so different that previous to this date it had been found impracticable to apply high pressure to such filters, the effect being inevitably to overturn the filtering bed and confound the materials with the liquid to be filtered;—that this being the difficulty, in this consisted the merits of the invention. M. Fonvielle had discovered the means of so retaining and compressing the materials, as to be able to apply high pressure, the sole agent which can operate on great masses of water. In a word, filtration on a great scale is the principal object of Fonvielle's patent. It was shown that the greatest effect of preceding methods was to filter *five hectolitres* (=132 gallons) per day, whereas it was proved that

filters of the "French Company," of the same capacity, would give in the same time *fifteen hundred and two thousand gallons*, or even more. Hence the evidence of a new idea—a great and real invention.

But the patent of the Company proves its value by two other new and happy applications: the first is the facility of cleaning the filter, without unpacking it, by a simple play of opening stop cocks, continued for 5 or 6 minutes only. This alone is enough to condemn every other filter, *which cannot, like those of the Company, clean themselves.* The second is the happy use of the laws of hydraulic level, in raising the filtered water to a height nearly equal to that of the fountain head, a principle of the highest utility in the domestic, and other, arts, while all other filters leave the water simply at their feet.

The honourable testimony of the Academy of Sciences, evidenced by the report of Arago,* was brought into view, and the advocate for the Company, at the conclusion, read another communication, addressed to the President from the same academician, containing some new developments of the scientific question, and treating this delicate and interesting subject in the enlightened manner, and with the energetic precision, which distinguish his pen. We cannot withhold the following extract from it:—

"I will add a few words on the merits of the question. This will only be pursuing the task I have long imposed on myself, of defending the rights of inventors, dead or living, against imitators, copyists, and plagiaries,—a task in which, to the great displeasure of the English, I have been allowed to restore to our countryman, Papin, the honour of the discovery of the steam engine, and of steam boats.

"When the law declares *in general terms* (en thése générale) that a patent shall never be granted for a simple idea, it goes perhaps beyond its own object; but it thereby shows the complete separation which society ought to make between a theoretical and a practical machine. To transform an apparatus which works with difficulty, or scarcely works at all, into a powerful, common, economical machine, which, occasionally, changes completely the manufacturing aspect of a whole nation—nothing more is sometimes requisite than an apparently insignificant alteration, which, in the shops, might be designated by the simple term, 'a turn of the hand.'

"The machine which we owe to the genius of Watt, includes no principle which is not seen in the much older machine of Newcomin, only the steam was no longer condensed in the body of the pump, but in a separate cylinder. What did Bramah add to the principles of Stevin and Pascal in the hydraulic press? Nothing, absolutely nothing! He only modified the shape of the large piston, so as to render it completely tight and staunch. Watt and Bramah are none the less regarded as the principal and most skilful promoters of British industry. M. Fonvielle may have added to the results of his predecessors only his demonstration of the possibility of filtering under strong pressure through filters *par excellence*, composed of sand and pounded sandstone; he may have only proved that the two materials in question can be so disposed as to maintain their situation under the action of rapid currents, and not mingle with and be carried away with the fluid mass,—he is still an inventor: but he has done more; he has found the means of cleaning the filter without dismounting it, without handling it. The two inventions united form a process whose efficiency is not contested, and which provide the means of filtering vast masses of water with very

* Journ. Frank. Inst. vol. xxii., p. 206.

small machines. Nothing like this existed before. Never, for example, had the city of Paris suspected the possibility of filtering, on the spot, the water of the public fountains. Now, our citizens are certain of soon seeing this valuable improvement realized. The only water not subjected to filtration will be that for washing the streets. Well! this might have been possible without any one having recently invented any thing! The able engineers of Paris, the hydraulic engineers of London, where the subject of filtering was not long since an object of parliamentary investigation, might have had in their eye all the elements of a simple, elegant, economical solution of the problem, and yet no one has seized hold of it! Vain supposition! Such pretensions cannot be supported, without opposing the most useful thing in the world—common sense itself.

"The name of the engineer *Tom* of Greenock, has been cited in the memoir of our adversaries. This name, which was parenthetically introduced into my report, did not prevent the celebrated Milne, engineer of the New River, the chief hydraulic establishment in London, from considering Fonvielle's apparatus as a good and useful invention. When lately Mr. Milne came to Paris with Mr. Curtis, President of the Bank of England, for the purpose of inquiring relative to a project for the distribution of water at each house, and on which occasion the Municipal Council charged me with the preparation of the account of charges, Mr. Milne declared to me that he intended to apply to the '*French Company*,' *and purchase from them the right to their process of filtering.*"

Rec. Soc. Polytech., Juilliet, 1838.

Progress of Civil Engineering.

Dr. Lardner's Instruments for Experimenting upon Railways and the Motion of Railway Carriages.

Instrument for Detecting Vertical Deflexion.—To test the formation and stability of the road, it was determined to observe the effects which the rails and their supports suffered by the action of the wheels in passing over them. Mr. Wood contrived and constructed instruments for this purpose, consisting of a simple lever, the shorter arm of which was placed either under the lip of the rail itself, or under a staple attached to the rail, so that when the rail would sink, the arm of the lever would be depressed, and if the rail would rise, the arm of the lever would rise also, by the superior weight of the longer arm. Thus every motion of the rail upwards and downwards would produce a contrary motion in the opposite end of the lever, and as the arms of this lever were unequal in the proportion of about six to one, the actual vertical deflexion of the rail was exhibited on a proportionally magnified scale by the motion of the longer arm. In order to register these deflexions, which usually were produced with great rapidity and in considerable number by the wheels of a train successively passing over the rail to which the instrument was attached, Mr. Wood adopted the same method as was previously used in several other self registering machines. A narrow strip of paper of considerable length, being rolled upon a small cylinder, was gradually unrolled from it to another cylinder, and as it passed from the one to the other, it was drawn over a disc, against which a pencil was pressed, which was carried by the longer end of the above-mentioned

ever. The motion of this pencil, upwards and downwards, produced by the deflexion of the rail, would, if the paper were quiescent, merely draw a vertical line upon it; but by the motion of the paper under the pencil, every separate motion of the pencil upwards and downwards, produced a waving line, the summit of each wave exhibiting the magnitude of each deflexion. Three of these instruments were constructed by Mr. Wood, with a view to expedite the taking of the observations, so that being applied to different parts of the rail, three sets of deflexions would at the same time be taken by one passage of a train.

Instruments for Measuring Lateral and Horizontal Deflexions.—It will be perceived that the effect of the last instrument was only to measure the deflexion of the rail downwards or upwards. After Dr. Lardner had been some time engaged in experimenting with these, he succeeded in constructing another set of instruments, capable of measuring similar effects in the lateral or horizontal direction. These instruments consisted of a compound lever by which any motion of the shorter arm was magnified fifty times, so that when the shorter arm was drawn back or drawn forward in the horizontal direction through the fiftieth part of an inch, the end of the longer arm was moved upwards or downwards, according to the direction of the motion of the shorter arm through the space of an inch. The shorter arm of this lever, bore by a hardened steel point upon a flat circular disc of steel constructed on the end of a short rod or cylinder, moving horizontally in guides. The other end of this cylinder was presented to the side of the rail to which was attached a hardened steel point which bore upon the disc; so that the cylinder thus moving in guides was placed between the two steel points, one attached to the rail, and the other to the short arm of the lever of the indicating instrument. The longer or indicating arm was furnished with a pencil, which registered its indications on paper, in the same manner as in the instruments contrived by Mr. Wood for registering the vertical deflexions. The two sets of instruments combined rendered the means of observation of the effects of carriages upon the rails complete. It is evident that the rail could not suffer any effect which would not be felt, measured, and registered by one or both of these instruments. To the experiments made with these instruments, at least one-third of the whole period of this inquiry was devoted, and many hundred diagrams were taken, exhibiting the effects produced not only on the rails themselves, but on the chairs by which they are supported on the timbers, where timbers are used, and on the stone blocks on which other railways are supported.

Instrument for Testing the Laying of Rails, &c.—In addition to these tests of the effects produced upon the rails by the traffic over them, Dr. Lardner proposed to apply another which would show the state of perfection with which the rails were laid, or their state after the lapse of any length of time. It is evident that on a straight line of railway, the two rails on which the wheels of the same carriage rest, ought to be at the same level, so that the carriage may stand in a truly horizontal position. A newly constructed road ought to be laid with sufficient precision to effect this; but after being worked for any length of time, it cannot be expected to preserve it. One rail will subside more than the other, owing to the different degree of firmness of its supports, and of the ballasting beneath them; in fact the rails will lose the correctness of their relative level, and the carriage, when resting on them, will not be as truly vertical in its position as it would be on a well and newly made railway. An instrument was contrived and constructed, which, being rolled slowly along the rails, wrote upon paper,

as it went, with considerable precision, the extent to which the rails of the same line departed from a common level. The operation of this instrument may be easily explained. An iron tube, of about an inch in diameter, is formed of a length equal to the gauge of the line, or the width of the rails; at each end of this are two shorter legs at right angles to it, open at their ends; thus when the intermediate tube is placed in the horizontal position, the two short legs may be brought to the vertical position; and if the horizontal tube be extended between the lines of rails, the vertical tubes will be immediately over the centre of each rail. Now let us suppose this instrument fixed to a vertical frame, and placed on wheels or rollers, which shall rest upon the rails; let mercury be introduced into it until the horizontal tube and about half of each of the vertical tubes are filled. If the rollers which support the instrument be now made to rest upon the rails, the short tubes being in an upright position, the two surfaces of the mercury in the short tubes must, by the laws of fluids, be at the same level. If the rails be not at the same level, then the mercury will stand higher in the tube which is over the lower rail, than in that which is over the higher one. If the instrument be reversed, the mercury will also reverse its position relatively to the instrument, and will still stand higher in the tube which is over the lower rail.

When the instrument is adjusted, which it may easily be by this process, so that when the rails are truly level, the height of the mercury in one of the tubes is accurately known, then every change which that column of mercury undergoes, while the instrument is rolled over the rails, will indicate a corresponding departure in the rails from the common level, that departure being twice as great as the rise or fall of the mercury.

In order to make this instrument register its own indications, Dr. Lardner placed on the column of mercury in the tube a float, the rod of which resting above the tube, moved in guides, so as to rise and fall regularly on the surface of the mercury on which it rested, rose, and fell; to this rod was attached a pencil, under which paper being moved in the usual way, a curve was described, whose height above a datum line was always equal to half the departure of the rails from a common level.

Among the several instruments, the invention and construction of which have arisen out of this important inquiry, there is not one which has equal general utility with this self-registering level, and it is only to be regretted that its construction was completed at so late a period that it has not been applied so extensively to the different lines as might have been wished. Its use, however, will not be confined to this investigation. The advantages which it will offer as a test of the condition of a newly made line, or of the manner in which the contractor will preserve one in operation, is obvious. It will be a check, whose indications cannot be disputed, and they are indications which involve the best qualities of a well made line. It is evident that its usefulness in practice may be extended by adding to it two other instruments on the same principle, to be rolled each along the same rail. The object of these would be to register every change of level of each rail, independently of the other, in addition to the register preserved by the present instrument of the departure of the two rails from a common level.

Instruments for Measuring the Vibration of Carriages.—An iron tube is extended across the floor of the carriage from door to door, from which rise two perpendicular legs at each door to the height of about twelve inches. The horizontal part of this tube extending along the floor is filled with mer-

cury, which likewise fills the legs to the height of some inches from the angle of the tube, being similar in all respects to the tube used in the instrument for recording the relative levels of the rails. The principal irregularity of motion to which railway carriages are liable, being a lateral swinging to the right and to the left between the rails, this motion immediately affects the horizontal column of mercury which fills the tube extending along the floor, and the inertia of this column causes the column in the vertical tubes to oscillate in proportion to the lateral vibration of the carriage. A float is placed on the mercury in one of the vertical tubes, which bears a pencil similar to that described in the self-registering level, which pencil inscribes on paper each particular oscillation of the mercury, and its exact extent.

This, however, is only one of several irregular motions to which the carriages are liable. Another of these is a rocking motion, arising partly from the former lateral vibration, and partly from the irregularity of the level of the rails, either side of the carriage alternately sinking and rising, either as the relative levels of the rails change, or as the conical tires of the wheels mount upon them and descend by the lateral vibration. This rocking motion would cause a body placed at either side of the carriage alternately to ascend and descend in the vertical direction through a corresponding space, and at similar intervals. This motion was measured in the apparatus in the following manner:—a syphon barometer, formed of an iron tube of nearly an inch in bore, was placed at the side of the carriage, near one of the doors. This barometer would be raised and lowered as the side of the carriage itself was elevated and depressed by the irregularity of the motion; and this alternate vertical motion being imparted to the mercury in the barometer, the latter, in virtue of its inertia, would receive a corresponding oscillation upon the same principle as the horizontal column in the tube was affected by the lateral motion. A float was placed in the shorter leg of the barometric syphon, which was made to inscribe the vibrations on paper in the same manner as the other instruments.

Besides this rocking motion, railway carriages, like others, are liable to more or less alternate vertical shake common to the whole body of the carriage; and although it was manifest that this was the smallest in amount of all the irregularities of motion, it was deemed right to ascertain it. This was accomplished by a small self-registering syphon barometer, placed in the centre of the carriage. All these three instruments were probably mounted upon the same frame, and their three pencils were made to act upon as many discs over which the paper was moved. The rolls of paper were all moved by the same winch, which acted upon a worm and a system of wheels driven by a common band, so that all the papers moved on the respective discs at the same rate, and received upon them the inscriptions corresponding to the different motions. In front of each disc was provided a stamp, bearing upon it the letter indicating the kind of motion recorded on the paper. Thus to the disc on which the horizontal motion was written, the stamp H was printed; to that on which the vertical motion was inscribed, the stamp V was printed; and that on which the rocking motion was recorded, was inscribed the stamp R. All these punches were attached to a common rod, and moved together by the lever provided for that purpose. A person stationed at the window of the carriage at the moment of passing each quarter of a mile, struck the lever with his hand, and punched a letter on the paper which moved over each disc. These letters divided the paper into spaces corresponding to each quarter of a mile, and vertical

lines were subsequently drawn from it, which resolved the diagrams thus formed into portions corresponding to each particular quarter of a mile of the road traversed.

In this manner the number of jolts of the carriage, and the nature and amount of each jolt which took place in each quarter of a mile, were registered.

So satisfactory have been the indications of this instrument, that by inspecting the diagrams the general state of the road can be with great certainty pronounced. In passing along a newly made line, for example, it is at once rendered manifest when the train passes from a cutting to an embankment, the latter being in a state of settlement, and therefore presenting more irregularity of surface.—*From Dr Lardner's Article on the Great Western Railway Inquiry, in the Monthly Chronicle.* Lond. Mech. Mag.

Railway Improvement Society.

A private meeting, very numerously attended by deputations from most of the leading railway companies, was held on Saturday, March 9th, 1839, at the chambers of Messrs. Burk and Venables, in Parliament street, for the purpose of considering the propriety of forming a society for promoting and advancing the scientific improvement of railways throughout the kingdom, and for protecting, generally, the interests of railway proprietors.

Mr. George Carr Glyn, the chairman of the London and Birmingham, and North Midland Railway Companies, was called to the chair, and opened the proceedings, by adverting to the great and manifest importance of the proposed society, as affording a means of bringing the united experience and influence of the principal persons connected with railways, to bear upon all questions which may arise respecting them.

The honourable chairman further alluded to the very great ignorance which exists among many, even at this day, on the subject of railways, and the consequent prejudices which prevail against them, and pointed out the great advisability of having some regularly organized association, which would be looked up to as an authority on all subjects in which their interests were involved.

The meeting was subsequently addressed by several other gentlemen present, who all concurred in the importance of the proposed association, and dwelt on the advisability of forming, at its outset, a collection of maps, reports, models, and other scientific and statistical details relating to railways, which should be accessible to the several members of the society, and which would, in time, become a most valuable and interesting museum of reference on matters connected with railways.

Some discussion took place as to the amount of the subscriptions, and the name to be given to the proposed association, viz. whether it should be called the "Railway Society," or the "Railway Institute," but eventually this, with all other matters of detail, was left to a committee of management, formed of some of the directors of the principal railway companies present, who were empowered to add to their number if they should see fit.

Resolutions, embodying the substance of the foregoing remarks, were unanimously passed, and the several persons present having enrolled their names as the first members of the Society, the meeting separated. Ibid.

On Framing Lock Gates without Iron Work. By S. Ballard, A. I. C. E.

The ledges, or horizontal pieces, are held to the back and mitre post by dovetail tenons and wedges, thus avoiding the use of iron T pieces and screw pins, which occasion the wood in immediate contact with them to decay, while the parts not pierced with iron are perfectly sound. This method was adopted in some gates on the Herefordshire and Gloucestershire Canal, and, after some years experience, is found completely successful. Tar and white lead are put into the mortises, and the wedge driven down upon it, so that every crevice is filled, and the joints rendered watertight; the planks also are fastened on with oak pins instead of nails.

Some discussion took place on the general opinion, that when dissimilar substances are in contact, as when a gate of one kind of wood is fastened with pins of another wood, some action tending to loosen the pins prematurely takes place betwixt them. Lond. Journ. Arts & Sci.

Tubing the Boilers of Locomotive Engines. By George Buck, M. Inst. C.E.

In this communication the author has attempted to determine the diameter of the tubes of the boiler of a locomotive engine, so that the effect in the generation of steam may be a maximum. The following are the conditions upon which the problem is solved:—That the evaporating effect of the hot air, in passing through the tubes, is in proportion to the extent of surface in contact with the hot air, and as the time of contact, conjointly. The following are the results of the investigation:—The distance between the centres of two adjacent tubes should be equal to four times the interval between their internal surfaces; the diameter of each tube should be equal to 3 times the same interval; that the tubes should be as near each other as possible.

In illustration, Mr. Buck has drawn two sets of tubes of the locomotive boiler as generally employed, and one as they would be arranged according to the results of this investigation. On comparing the products of the aggregate periphery, and the aggregate area of the tubes, it appears that the boiler tubed according to the above theoretic proportion is from 23 to 26 per cent. superior to the others. Ibid.

Mechanics' Register.

Roberts' Self-Acting Mule.

The petition of Mr. Roberts, of the firm of Sharp, Roberts & Co. of Manchester, praying for a prolongation for seven years, of the several patents granted to him in the year 1825, for the United kingdom of Great Britain and Ireland, for that important invention, was heard lately before the judicial committee of her majesty's privy council:—present, the marquis of Landsdowne, lord president; lord Lyndhurst, lord Brougham, and Sir Herbert Jenner. Counsel for the petitioner, Sir Frederick Pollock, and Mr. Teed. No caveat having been entered to oppose the application, the Attorney General briefly addressed their lordships, stating that on the part of the crown, he had no objection to offer to the prayer of the petitioner being granted. A model of the machine was then exhibited, and the nature and objects of the invention were explained to their lordships. Evidence was

next given in support of the allegations contained in the petition; and after a short consultation, the marquis of Lansdowne, on behalf of the judicial committee, granted a prolongation of the several patents for the term prayed for, on account of the great ingenuity and merit of the invention, and the obstacles which had, from time to time, been opposed to prevent the patentee from deriving a fair compensation for so important an invention during the original term of the patents. Lond. Mech. Mag.

The Patent Safety Fuze.

Before the invention of the safety fuze, the loss of life in the Cornish mines was frightful. No one, unless entirely destitute of benevolence, could then take up a newspaper without having his soul harrowed with the heart-rending accounts of mutilations and loss of life, arising from premature explosions in blasting. Nearly every week the shocking details were before us. To one the light of heaven was no longer a blessing—another passed the remainder of his life a maimed man, while many left widows and children to helpless lamentation and starving want. The safety fuze was introduced—mine after mine adopted it—and, in proportion as the circle of its use became wider, the accidents within the circle became fewer. At the present time, being used in nearly all the mines in Cornwall, nearly all accidents from premature explosions have ceased. The fuze is about $\frac{3}{16}$ths of an inch in diameter, and has the appearance of varnished cord. Its advantages over every thing previously used are many, and striking. The time of the laborers is saved; no needle being used, no time is lost in priming, making touch-paper, &c. The fuze is placed in the charge, tamped up, and immediately fired. It burns so slowly (about eighteen inches a minute) as to afford ample time for the laborers to retire. It is certain—not one in a thousand fails—with care, not one in a million. Disregarding the saving in time, and the certainty—and this is immense—the whole expense of the fuze is saved in gunpowder alone. Owing to the size of the nail hole, in the common process, much of the powder escapes; the whole of this is saved, and it amounts as proved by experiment, to fully one-fifth of the gunpowder used. It is equally applicable to wet ground as to dry, for conveying fire 200 hundred feet under water, as through the air or beneath the earth. Combining then certainty, economy, and safety, the safety fuze is one of the most useful inventions of the nineteenth century.—*Sheffield Iris.* Lond. Mining Journ.

A Fact for Frame-work Knitters.

Under the head of "Hosiery," the Penny Cyclopædia contains the following observations, which are already, or will presently be, applicable to every branch of cotton manufacture:—"At this moment, (July, 1838,) stocking frames, with a rotary action, in which 12 fashioned stockings are made at the same time, superintended by only one man and a boy, and worked by steam power, have been successfully brought into operation at Nottingham, and bid fair to supersede the use of the reciprocating engine, in which but one stocking can be made at once by a single workman. The economy in the process of manufacture that will be thus effected, is very great, and may be the means of securing to our manufacturers for some time longer the supply of foreign countries—a branch of trade which was fast leaving us. The principal seat of the cotton hosiery manufacture abroad is at Chemnitz, in Saxony, where, owing to the low rate of wages, as compar-

ed with the earnings of the weavers of Nottingham, goods are made with yarns imported from Lancashire, at prices which have excluded English goods from third markets, and have even brought them into consumption in this country, after paying a duty of 20 per cent.!" Lond. Mech. Mag.

Amount of Silver Produced in Great Britain.

The total quantity of silver annually produced by the mines of Great Britain, is not, perhaps, very accurately known, being derived from fluctuating and scattered sources, but may, I believe, at the present time, be estimated at 10,000 pounds troy, and may therefore amount in value to nearly 80,000*l.* Notwithstanding the occasional production and richness of the actual ores of silver in some of our mines, it is certain that they do not at present contribute any very large proportion to this amount, of which the greater part is derived from argentiferous galena. The same remark, indeed, may be applied to the silver produced by the mines of Europe generally, in most of which argentiferous galena is the most productive ore.

From the present activity of the lead mines, the trials making in the Beeralston district, and other circumstances, combined with the very ingenious and economical mode of refining lead, which has been introduced within the last few years by Mr. Pattinson, of Alston, and by which a much smaller produce of silver may be profitably extracted than was formerly the case, it does not appear improbable that the amount of silver may be in time somewhat increased, although it is never likely to form a very important feature in the mineral produce of this country. Lond. Min. Rev.

Statue to Geo. Stephenson.

We observe, with pleasure, that a well-deserved tribute of admiration and respect is about to be paid to an individual, to whose genius and untiring energy his country is deeply indebted for one of her grandest modern improvements—the formation of railways, and the application of locomotive power—we allude, of course, to George Stephenson, Esq. A committee has been formed, embracing many of the first names connected with the iron trade, to consider the subject of a "Stephenson Memorial;" and we hear that a colossal statue is spoken of, to be erected in such part of the kingdom as may hereafter be determined upon, and formed of that most appropriate material —cast-iron. Lond. Min. Journ.

Glass Cloth.

We have been favoured with an inspection of a new and curious fabric, manufactured by Mr. Richard Baker, of Ossett, near Dewsbury; it is a web of glass cloth, which has a very splendid appearance. The ingenious manufacturer has so far succeeded in annealing this very brittle substance, as to admit of its being wove like cloth. It is deposited for inspection in the North of England Society of Arts, together with a slipper of the same material.

Ibid.

LUNAR OCCULTATIONS FOR PHILADELPHIA, JULY, 1839.

Angles reckoned to the right or westward round the circle, asseen in an inverting telescope. ☞ For direct vision add 180° ☜

Day.	H'r.	Min.	Star's name.	Mag.	Angle from Moon's North point.	Angle from Moon's Vertex.
1	13	33	Im. φ Aquarii	,5,	142°	104°
1	14	43	Em.		290	264
6	15	30	Im. b Pleiadum	4,5	135	80
6	16	23	Em.		274	217
6	16	14	Im. c "	5	176	120
6	16	43	Em.		234	178
6	16	0	Im. d "	5	69	13
6	16	43	Em.		341	285
6	16	30	Im. e "	3	80	25
6	17	21	Em.		330	274
8	15	47	Im c Tauri	4.5	44	355
8	16	17	Em.		335	285
14	8	3	Im c Leonis	5.6	88	138
14	8	55	Em.		207	258
26	8	50	Im χ^3 Capricorni	6	80	39
26	9	54	Em.		320	285
28	15	24	N. App. ☽ and 81 Aquarii 6 ☽ So. 0'4			

Meteorological Observations for January, 1839.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	10	23	30.76	30.70	W.N.E.	Moderate.		Clear—do.
	2	24	37	50	30	E.	do.		Cloudy—do.
	3	33	39	30	24	E.	do.		Cloudy—do.
	4	33	38	10	12	N.	do.		Cloudy—do.
	5	31	38	25	25	N.W.	do.		Cloudy—do.
	6	3	33	35	38	N E.	do.		Clear—do.
☽	7	29	37	10	29.90	S.E.	do.		Cloudy—do.
	8	40	41	29.65	86	W.	Brisk.		Clear—do.
	9	23	36	30.:5	30.25	N.W.S.E.	Moderate.	.01	Clear—cloudy—snow.
	10	32	40	0	29.96	S.W.	do.		Clear—do.
	11	40	53	00	30.00	S.W.W	do.		Clear—do.
	12	43	64	29.86	29 85	S W.	do.		Clear—do.
	13	32	38	30.20	30.20	W.	do.		Clear—do.
⊗	14	32	39	29.9	29.95	S.W.N.E.	do.		Cloudy—do.
	15	20	24	90	90	N.E.	Brisk.	.62	Snow—do.
	16	12	24	30.00	30.00	W.	Moderate.		Clear—do.
	17	14	32	05	10	W	do.		Clear—lightly cloudy.
	18	19	36	10	05	W.	do.		Clear—do.
	19	29	41	29.84	29.90	W.S.W.	Calm.		Flying clouds—clear.
	20	8	24	95	30.00	W.	Moderate.		Clear—do.
	21	24	31	75	29.75	S.W.W.	do.		Cloudy—do.
☾	22	0	23	60	60	S.W.	Brisk.		Clear—cloudy.
	23	20	12	40	30.15	W.	Blustering.	.02	Snow squall—clear.
	24	3	19	30.15	15	W.	Moderate.		Clear—do.
	25	16	39	15	95	S E E.	do.		Cloudy—do.
	26	46	42	29.40	28.80	S.E.	Brisk.	3.68	Rain—do.—great freshet.
	27	24	27	30	29.33	W.	do.		Cloudy—lightly do.
	28	14	26	50	5	W.	do.		Cloudy—do.
	29	21	31	56	60	W.	Moderate.		Clear—do.
⊛	30	29	40	63	70	S.W.	do.		Cloudy—do.
	31	28	35	30.00	30.06	W.	do.		Clear—cloudy.
	Mean	24 83	34.16	29 95	29.95			4.33	

	Thermometer.		Barometer.
Maximum height during the month.	62.	on 12th.	30.76 on 1st.
Minimum " " "	3.	24th.	28.80 26th.
Mean	29.50		29.953

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

MAY, 1839.

	County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.
1	Philadelphia,	Philadelphia,	J. P. Espy.	58.11	73.12	61.41	84.	41.	64.21	7	40.	55.06	7	29.92	29.89	29.86	30.16
2	Montgomery,																
3	Bucks,	Newtown,	L. H. Parsons.	65.21	72.97	60.77	85.	53.	66.32	1	45.	57.08	6	29.95	29.93	29.92	30.18
4	Lehigh,																
5	Northampton,																
6	Monroe,	Stroudsburgh,	A. M. Stokes.	52.58	70.37	59.53	85.	36.	60.83	2/3	.....	.....	.	29.44	29.45	29.44	29.68
7	Pike,																
8	Wayne,																
9	Susquehanna,	Silver Lake,	E. Rose.	52.13	65.84	59.90	78.	40.	59.32	.	39.	49.77	.	28.02	28.03	28.03	28.30
10	Luzerne,																
11	Schuylkill,	Pottsville,	John Porter.	56.19	67.68	58.62	83.	38.	60.83	1/3	31.	48.11	2	29.09	29.05	29.05	29.47
12	Berks,	Reading,	C. F. Egelman.	57.55	68.03	57.77	82.	42.	61.12	.	....	.....	.	29.70	29.69	29.69	29.95
13	Chester,																
14	Delaware,	Haverford,	Haverford School.	57.89	70.54	62.17	82.	50.	63.53	14	40.	54.04	13	29.41	29.34	29.39	29.68
15	Lancaster,	Lancaster,	Conservatory of Arts,	56.76	71.89	61.	84.50	40.50	63.22	1/3	37.	53.84	.	29.44	29.43	29.45	29.68
16	York,																
17	Lebanon,																
18	Dauphin,																
19	Northumberland	Northumberland	Andrew C. Huston.	56.36	69.85	60.34	83.	39.	62.18	.	31.	47.82	.	29.38	29.34	29.34	29.63
20	Columbia,																
21	Bradford,																
22	Tioga,																
23	Lycoming,																
24	Union,																
25	Mifflin,	Lewistown,	J. Culbertson, M. D.	61.87	74.73	64.49	79.50	47.	67.23	5	....	.....	.	29.27	29.20	29.27	29.52
26	Juniata,	Mifflintown,	Andrew Parker.	59.83	67.52	66.76	79.	51.	64.70	3 1/3	....	.....	.	29.54	29.53	29.51	29.75
27	Perry,																
28	Cumberland,	Carlisle,	Prof. W. H. Allen.	59.52	69.20	59.55	81.	45.	62.76	1/3	30.	48.71	.	29.35	29.31	29.32	29.60
29	Adams,	Gettysburgh,	Prof. M. Jacobs.	57.05	71.51	59.59	85.25	40.50	62.71	.	31.50	50.	.	29.38	29.32	29.32	29.62
30	Franklin,																
31	Huntingdon,																
32	Centre,	Bellefonte,	John Harris.	53.14	72.29	57.15	86.	36.	60.86	3	29.	43.17	8	29.15	29.16	29.15	29.43
33	Potter,																
34	M'Kean,	Smithport,	Richard Chadwick.	48.67	63.45	51.42	81.	32.	54.51	.	23.	40.32	.	29.14	29.28	29.22	30.
35	Clearfield,																
36	Cambria,																
37	Bedford,																
38	Somerset,																
39	Indiana,																
40	Jefferson,																
41	Warren,																
42	Venango,																
43	Armstrong,																
44	Westmoreland,																
45	Fayette,																
46	Green,																
47	Washington,																
48	Alleghany,																
49	Beaver,																
50	Butler,																
51	Mercer,																
52	Crawford,	Meadville,	William Reynolds.	51.78	76.19	54.31	87.	33.	60.76	.	27.	46.13	.	28.64	28.63	28.63	28.91
53	Erie,																

LUNAR OC			Thermometer.						Barometer.						
						Register.									
Day.	H'r.	M	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.
1	13														
1	14		84.	41.	64.21	7	40.	55.06	7	29.92	29.89	29.86	30.16	29.54	29.89	6⅔
6	15														
6	16		85.	53.	66.32	1	45.	57.08	6	29.95	29.93	29.92	30.18	29.57	29.93	1
6	16														
6	16														
6	16		85.	36.	60.83	⅔	.....	.....	.	29.44	29.45	29.44	29.68	29.	29.44	⅓
6	16														
6	16														
6	17		78.	40.	59.32	.	39.	49.77	.	28.02	28.03	28.03	28.30	27.60	28.03	.
8	15														
8	16		83.	38.	60.83	⅓	31.	48.11	2	29.09	29.05	29.05	29.47	28.	29.06	⅔
14	8		82.	42.	61.12	.	....	.....	.	29.70	29.69	29.69	29.95	29.32	29.69	.
14	8														
26	8		82.	50.	63.53	14	40.	54.04	13	29.41	29.34	29.39	29.68	29.09	29.38	15½
26	9		84.50	40.50	63.22	½	37.	53.84	.	29.44	29.43	29.45	29.68	29.04	29.44	⅓
28	15															
			83.	39.	62.18	.	31.	47.82	.	29.38	29.34	29.34	29.63	28.97	29.35	.
Moon.	Days														
			79.50	47.	67.23	5	....	.....	.	29.27	29.20	29.27	29.52	28.89	29.25	5
–			79.	51.	64.70	3½	....	.....	.	29.54	29.53	29.51	29.75	29.10	29.53	3½
		1														
		2														
		3	81.	45.	62.76	⅓	30.	48.71	.	29.35	29.31	29.32	29.60	28.95	29.33	⅓
		4	85.25	40.50	62.71	.	31.50	50.	.	29.38	29.32	29.32	29.62	28.96	29.34	.
		5														
		6														
☽		7														
		8	86.	36.	60.86	3	29.	43.17	8	29.15	29.16	29.15	29.43	28.79	29.15	3
		9														
		10														
		11	81.	32.	54.51	.	23.	40.32	.	29.14	29.28	29.22	30.	28.80	29.21	.
		12														
		13														
⊗		14														
		15														
		16														
		17														
		18														
		19														
		20														
		21														
☾		22														
		23														
		24														
		25														
		26														
		27														
		28														
⊛		29														
		30														
		31														
	Mean	2	37.	33.	60.76	.	27.	46.13	.	28.64	28.63	28.63	28.91	28.24	28.63	.
Maximum hei																
Minimum																
Mean																

	Mean.	Days omitted.	Weather.								Winds.															Hygrometer.					No. of Report.
			Clear.	Cloudy.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	Days omitted.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	
54	29.89	6⅔	13⅔	10⅔	....	....	....	..	....	6⅔	2	⅓	1⅓	1⅓	3⅔	.	⅓	⅓	2⅔	2⅓	2⅓	.	1⅔	1⅓	2	.	4⅓	5	....	.	.....	62.67	7	801
57	29.93	1	11⅓	17	....	...	....	..	7.496	2⅓	.	.	6⅔	1⅓	1	.	2	.	.	.	3	⅓	1⅔	⅓	11⅓	.	.	3⅓	61.40	11	.....	....	.	805
	29.44	⅓	13⅓	16⅔	7	....	....	2	3.870	1	4⅓	.	2⅓	.	1	.	3	.	3⅓	.	4⅓	.	4⅓	.	7⅔	.	.	⅔	....	.	.....	65.52	2	750
60	28.03	.	12	19	....	....	....	..	3.270	.	.	.	.	.	.	.	.	1	4⅓	⅓	9	.	8⅔	4⅓	3⅓	.	.	.	....	.	.....	....	.	755
	29.06	⅔	17⅓	13	8	....	....	..	5.476	⅔	.	.	⅓	.	1⅓	.	4⅔	.	⅔	.	3	.	4	.	12⅓	.	4⅓	⅓	....	.	.....	....	.	738
62	29.69	.	11⅓	19⅔	5	....	....	5	4.567	.	1	.	2⅔	.	2⅓	.	2	.	⅔	.	6	⅓	6⅔	.	9⅔	.	.	.	....	.	.....	....	.	737
59	29.38	15⅓	4⅔	11	....	....	....		2.896	15⅓	⅔	.	3⅓	.	⅔	.	⅓	.	1	.	3⅓	⅔	1⅔	⅔	4⅔	.	⅓	13⅓	54.80	26	.....	....	.	748
54	29.44	⅓	18⅓	12⅓	10	....	....	4	3.175	⅓	1⅓	⅓	3	⅓	2	⅓	3⅓	.	3	1⅓	4⅓	⅔	3⅓	2	4⅔	⅔	.	.	48.34	3	.....	59.86	3	752
7	29.35	.	9⅓	21⅓	14	....	....	3	3.386	.	3⅔	.	1⅔	⅓	1⅔	⅓	2⅔	.	5	.	1⅔	.	3⅓	1	4	⅔	5	⅓	....	.	.....	62.10	.	741
9	29.25	5	13⅓	12⅓	.	....	....	2	....	5⅓	⅓	.	⅔	.	.	⅓	1⅔	1	.	5	3	1⅓	.	.	6⅔	.	.	11	....	.	.....	....	.	792
0	29.53	3⅓	.	.	....	....	....	..	....	.	2⅔	.	2⅔	.	2⅓	.	2⅓	.	3⅓	.	3	.	4⅓	.	7⅓	.	.	3⅔	....	.	.....	....	.	740
5	29.33	⅓	12	18⅓	7	....	....	5	4.182	⅓	.	.	1	⅓	1⅔	⅔	2⅔	.	1	⅓	2⅓	2	5	⅓	1⅔	1⅓	10⅔	⅓	48.70	4	.....	58.18	4	739
6	29.34	.	15	16	3	....	....	8	3.394	.	1⅓	⅔	2⅔	.	⅔	1⅓	1⅔	⅔	3⅓	2⅔	6	1⅓	4⅓	1	2⅔	⅓	⅓	.	53.14	.	.....	60.64	.	749
9	29.15	3	10	18	10	....	....	1	6.075	3	1	.	2	⅓	1	⅓	1	⅓	3⅓	⅓	5⅓	1⅓	7	⅔	3	1	.	3	....	.	.....	....	.	757
0	29.21	.	11⅔	19⅓	....	....	....	..	4.386	.	.	.	.	.	3⅔	.	2⅔	.	.	.	4	.	11⅓	.	4	.	5⅓	.	57.86	5	.....	60.	1	747
4	28.63	.	11⅓	19⅔	9	....	....	5	5.039	.	.	.	.	.	1	⅓	⅓	⅓	1⅓	1⅔	2⅓	1⅓	2⅓	.	3⅔	⅔	15⅔	.	....	.	.....	....		746